OCT 23 1958

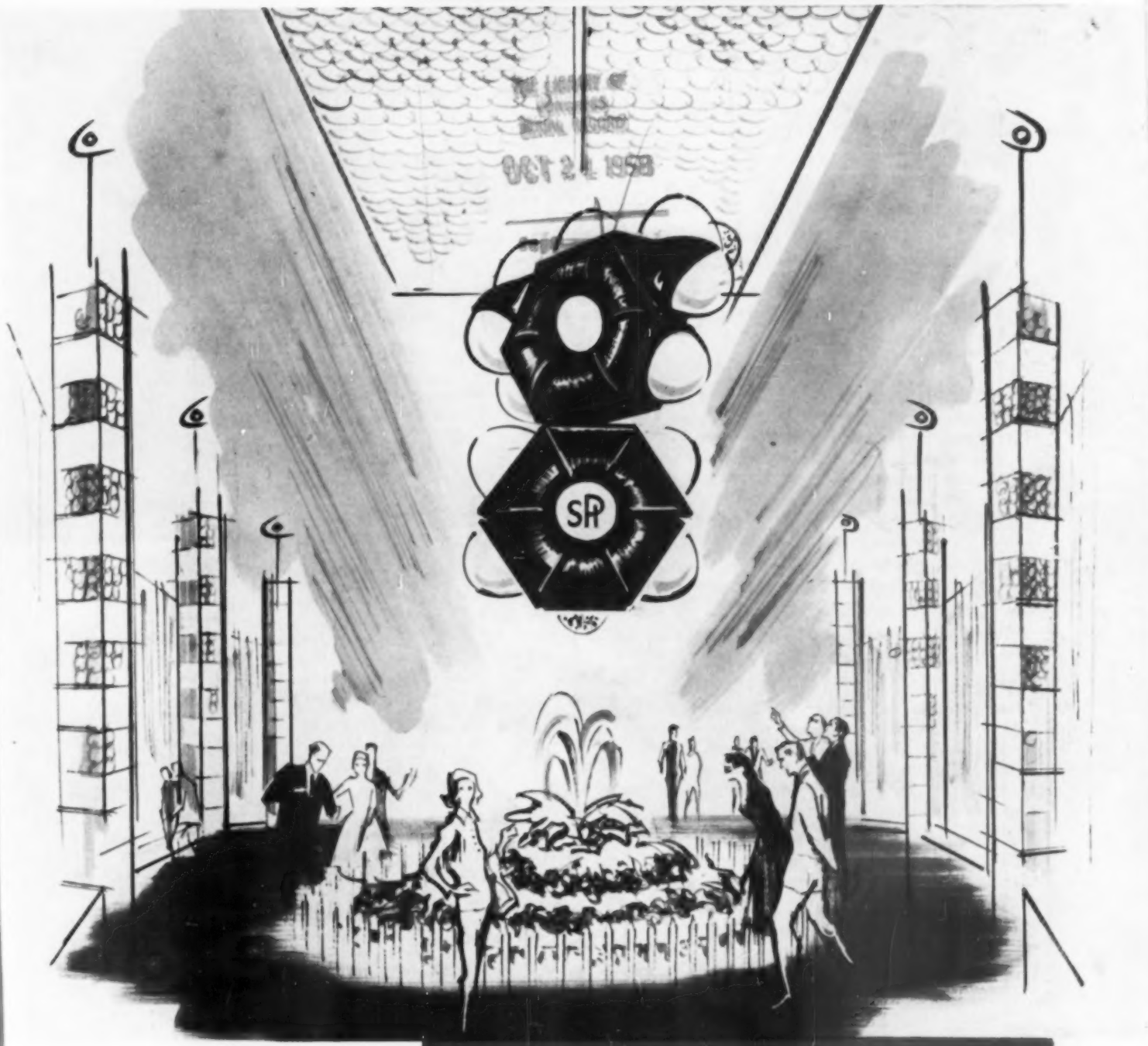
PLASTICS TECHNOLOGY

OCTOBER, 1958

Special Feature on
PLASTICS EXPOSITION

THE MAGAZINE OF APPLIED ENGINEERING

OCT 24 1958



SPI THEME CENTER FOR EIGHTH NATIONAL PLASTICS EXPOSITION

See Feature Section/page 931

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If potting, laminating, sealing or encapsulation are factors in your operation, you should investigate Epon resins. Because they provide a unique combination of desired electrical and physical properties, they are finding increased use in many phases of the electrical industry.

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Laminating . . . Epon resin, laid up with inert fibrous fillers, produces laminates with superior dielectric properties and moisture resistance. Epon resin laminates can be dip soldered, sheared, punched and drilled, and provide *excellent dimensional stability.*

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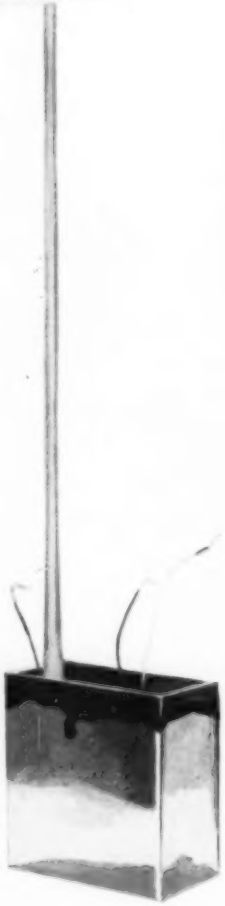
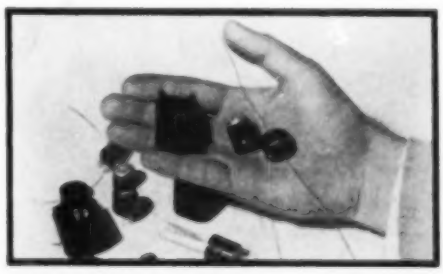
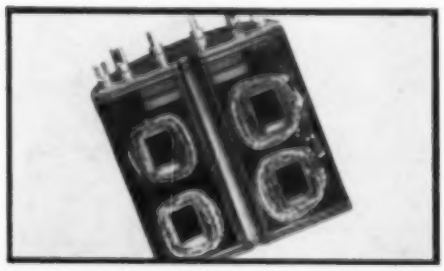
Can Epon resins solve a production problem for you? For assistance and technical literature, write us now.





These miniature electronic components potted in Epon resin will withstand solder bath temperatures and retain excellent dimensional stability.



Sections of magnetic amplifier coils, when embedded in Epon resin, have exceptional resistance to solvents and chemicals

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OCT 23 1958

Another new development using

B.F.Goodrich Chemical *raw materials*

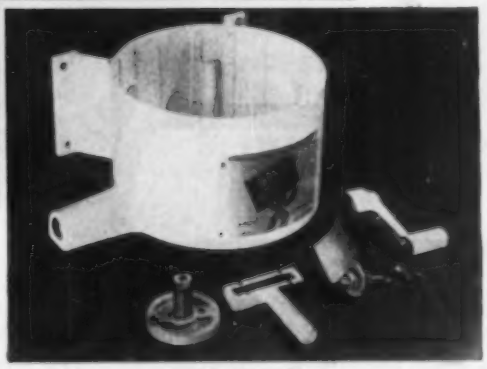
rigid Geon vinyl makes it rugged, rust-proof and attractive

For good looks, durability and cost savings, too, these soap dispensers for plant and office washrooms are made of high impact rigid Geon vinyl.

These dispensers are durable—they resist breakage—and they won't rust, corrode or react chemically with the soaps they dispense. Total cost is less, since no finishing or painting is required, and colors can be molded in the material.

Rigid Geon is also used for piping, fittings, and extruded shapes. Foam Geon makes cushions and safety padding. Protective coatings for steel, paper, upholstery and flexible wire insulation, too, are made from versatile Geon polyvinyl materials.

For technical information on Geon, write Dept. LG-6, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



Soap dispenser housing, crank, plunger, plug and disk are polyvinyl compound molded of rigid Geon by Tube Turns Plastics, Inc., Louisville, Kentucky, for Sugar Beet Products Company, Saginaw, Michigan. Rigid Geon compounds are supplied by B.F.Goodrich Chemical Co.

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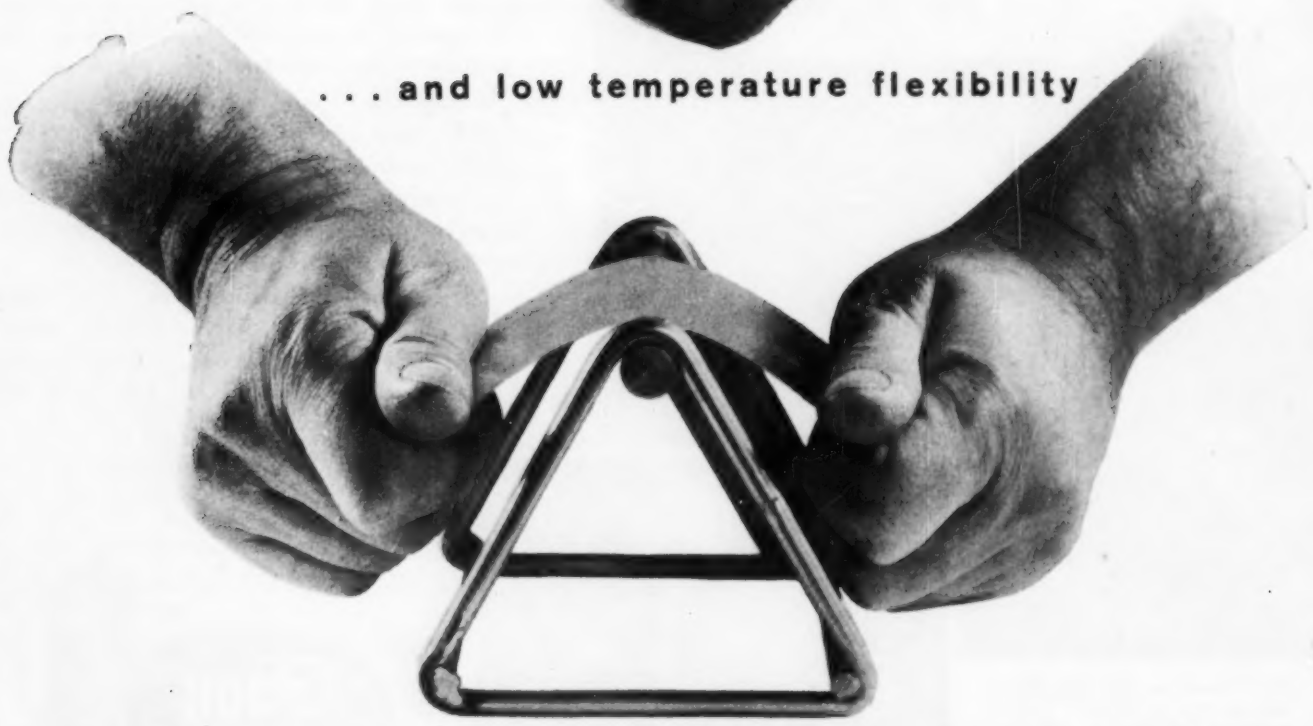

Flame-retardant Celluflex CEF imparts desirable improvements to the physical properties of polyvinyl emulsion systems used for protective coatings, adhesives and textile coatings. Fire retardance, ultra-violet light stability, and low temperature flexibility are imparted to these applications by this efficient tris-B-chlorethyl phosphate plasticizer. In adhesives, it also displays an exceptional tackifying property.

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PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

OCTOBER 1958 VOLUME IV NUMBER 10

FEATURE ARTICLES:

909 **DETERMINING MOLECULAR WEIGHTS OF THERMOPLASTIC MATERIALS** ..... *W. T. Blake*
The Brabender Plastograph is shown to give simple, rapid and accurate determination of value to the production man and process engineer.

913 **CREEP CHARACTERISTICS OF LAMINATED EPOXY PLASTICS** *John Delmonte*
Results of tests show effects of cure conditions, hardener content, and additives on creep properties.

918 **NECK-IN PROBLEM IN POLYETHYLENE EXTRUSION COATING AND FILM CASTING** *Dan Lewis and W. F. McDonald*
Investigation shows the necessity for obtaining a favorable compromise between neck-in and draw-down for best practical results.

921 **FABRICATING THE STRUCTURAL COMPONENTS OF THE ALL-PLASTIC "HOUSE OF THE FUTURE"** .... *C. G. Cullen*
A step-by-step discussion of the design components, materials, performance requirements, and operations in making the structural members in the Monsanto "House."

GUEST EDITORIAL:

917 **LET'S TELL THE PEOPLE** ..... *Betty Lou Raskin*

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931 **EIGHTH NATIONAL PLASTICS EXPOSITION**

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928 **EXPLORING FABRICATION TECHNIQUES** ..... *L. J. Zukor*

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The opinions expressed by our contributors do not necessarily reflect those of our editors

Letters to the Editor

Previews of Next Month

The following articles will be published in the November issue:

Correcting Warpage in Reinforced-Plastic Products. Thomas Harris, V-P, Structural Fibers, Inc., Chardon, Ohio

•

Ultra-Sonic Cleaning of Plastics Spectacle Frames. Don May, V-P, May Mfg. Corp., Woodside, N. Y.

•

NOL Ring Test for Glass Roving-Reinforced Plastics. P. W. Erickson, Sr. Project Engr., I. Silver, Chief of Non-Metallic Matls. Div., and H. A. Perry, Jr., Consultant on Non-Metallic Matls., U. S. Naval Ordnance Laboratory, Silver Spring, Md.

•

Controlling Profits in the Molding Plant. D. A. Dearle, Plastics Div. Mgr., North & Judd Mfg. Co., New Britain, Conn.

•

Guest Editorial: **"Modernization,"** by N. W. Oberle, Sales Mgr., Plastic Press Div., Baker Brothers, Inc., Toledo, Ohio

Highlights of this Issue

Determining Molecular Weights of Thermoplastic Materials. (p. 909)
The C. W. Brabender Plastograph provides a simple, rapid, and accurate means for determining molecular weights of resins. Examples are given to show the resulting data to be meaningful and useful to the engineer and production man.

•

Creep Characteristics of Laminated Epoxy Plastics. (p. 913)
Test results are given to show the effects on creep characteristics of cure conditions, hardener content, and various additives.

•

Neck-In Problem in Polyethylene Extrusion Coating and Film Casting. (p. 918)
Machine conditions and resin conditions are shown to influence neck-in. The former is a function of three variables, while the latter is controlled by density and melt index.

•

Fabricating the Structural Components of The All-Plastic "House of the Future." (p. 921)
The design components, materials, performance requirements, and production operations used for the structural members of the House are discussed and explained.

Information Wanted

Dear Sir:

We are interested in procuring jars made of plastic to replace ordinary quart fruit jars which we are now using. Any information you can supply as to where we might procure this type jar would be greatly appreciated.

W. T. Stanford, Jr.
Stanford Engineering Co.
Salem, Ill.

•

Dear Sir:

We would appreciate any information you can give us as to possible sources for plastic bedpans for hospital use, an item that can be sterilized for re-use.

B. Weiner, Pres.
Coseco Corp.
Los Angeles, Calif.

•

Dear Sir:

We would appreciate your advising us of the name of the manufacturer of a machine for shredding Styrofoam scrap. We are not interested in a grinder or chopper.

Frank C. Braun
Plasticfoam Products
New York, N. Y.

•

Dear Sir:

We are manufacturers of wood waste products and premix molders. We are now contemplating to add the reconditioning of plastic bowling pins to our operation. I wonder if you could give us some information and help in setting up such an operation. What type of plastic is used? What process is employed? What type of equipment? And all other information you can give us on this matter.

Carl Reininger
Ability Products Co.
Pasadena, Calif.

•

Dear Sir:

A prospect of ours has complete facilities for making both rigid and flexible plastic extrusions, and have made such products as glazing channel, welting, screen spline, stripping, and tennis tapes. Up to now they have been used principally as a job shop, but are interested in making a product for national distribution.

Do you have any suggestions as to some possible product they could consider for using these facilities, potential market size, or where they might go for help?

(Identity Withheld)

•

Dear Sir:

A client of ours is seeking a source for high tensile strength thermosetting plastic that is impervious to the hydrocarbons. We understand several new plastics have been developed in the last two years, and we felt perhaps you could send us the names of the manufacturers of these new developments.

(Identity Withheld)

•

Dear Sir:

We are interested in Mylar plastic sheets. Kindly advise us of the names of two or three manufacturers of this type of material. Thanking you, we are,

Walter Malowan Co.
New York, N. Y.

•

(Replies from our readers are invited for transmittal to the inquirers.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

"Quote . . . Unquote"

Glycerine Derivatives for Plastics

"It is important to note that the development interests of those producing glycerine from propylene are not simply focused on glycerine as such, but on the entire chain of intermediate and precursor chemicals. Shell Chemical, for example, has not been concerned with epichlorohydrin and epoxy resins. They have announced that, with the completion of facilities for the acrolein route to glycerine, more allyl chloride will be released for epoxys, allyl amines and other derivatives. Dow has announced a hydroxyl propylglycerine plasticizer and stressed other developments in the polymer and resin field.

"Large-scale availability of acrolein, expected as a result of Shell's hydrogen-peroxide-acrolein route to glycerine, suggests that some products which in the technical literature are called 'glycerine derivatives' but have never been commercially manufactured may be available as acrolein derivatives in the future.

"While interest in glycerine is common, exploration of derivatives of glycerine's precursor chemicals necessarily calls for an individual, rather than a cooperative program, as the character and cost of these precursors differ with each process. If such research suggests some development which will justify additional capital investment—particularly if it leads to a profitable specialty — the chemical producer himself may be alert to move in this direction.

"Producers of glycerine as a co-product of soap and fatty acids, judging by past indications, do not have the same interest in investing new capital in derivatives to extend the glycerine market. Their concern is to dispose of glycerine, rather than to enter an interrelated multi-product chemical business around it.

"It seems to me that these differences in areas of interest toward derivatives and applications is a healthy one for the (glycerine) industry, even though it has withdrawn . . . some of the former unity of effort toward joint research.

"Usually, when a product such as styrene is being produced by different companies, all will have about the same developmental background and, therefore, offer the same areas of technical know-how to customers. By contrast, producers of glycerine from today's duality of sources offers a highly diverse research and commercial background.

"Frankly, I do not think that the producers of glycerine themselves have taken full advantage of the breadth of this background, either in surveying possible fields of application, or in their technical sales service work for customers."

E. S. Pattison, Mgr.
Glycerine Producers' Assn.
New York, N. Y.

gp

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- They accept a wide pre-heat latitude, and are not hypersensitive to small changes in molding conditions.
- Their molded physical and electrical properties are also of high quality.

Although we will never stop improving our formulations, Plenco 433 and 482 do represent many years of specialized experience in supplying phenolic compounds to a critical and competitive molding industry. If you are not using these modern, tested-quality compounds, tell us the flow required and we will be pleased to forward a sample.

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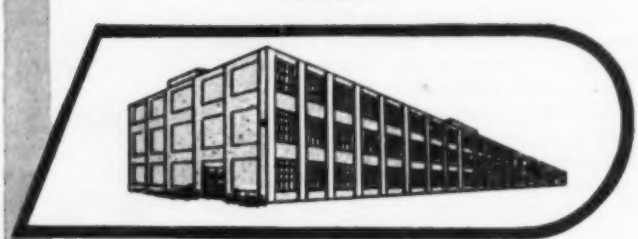

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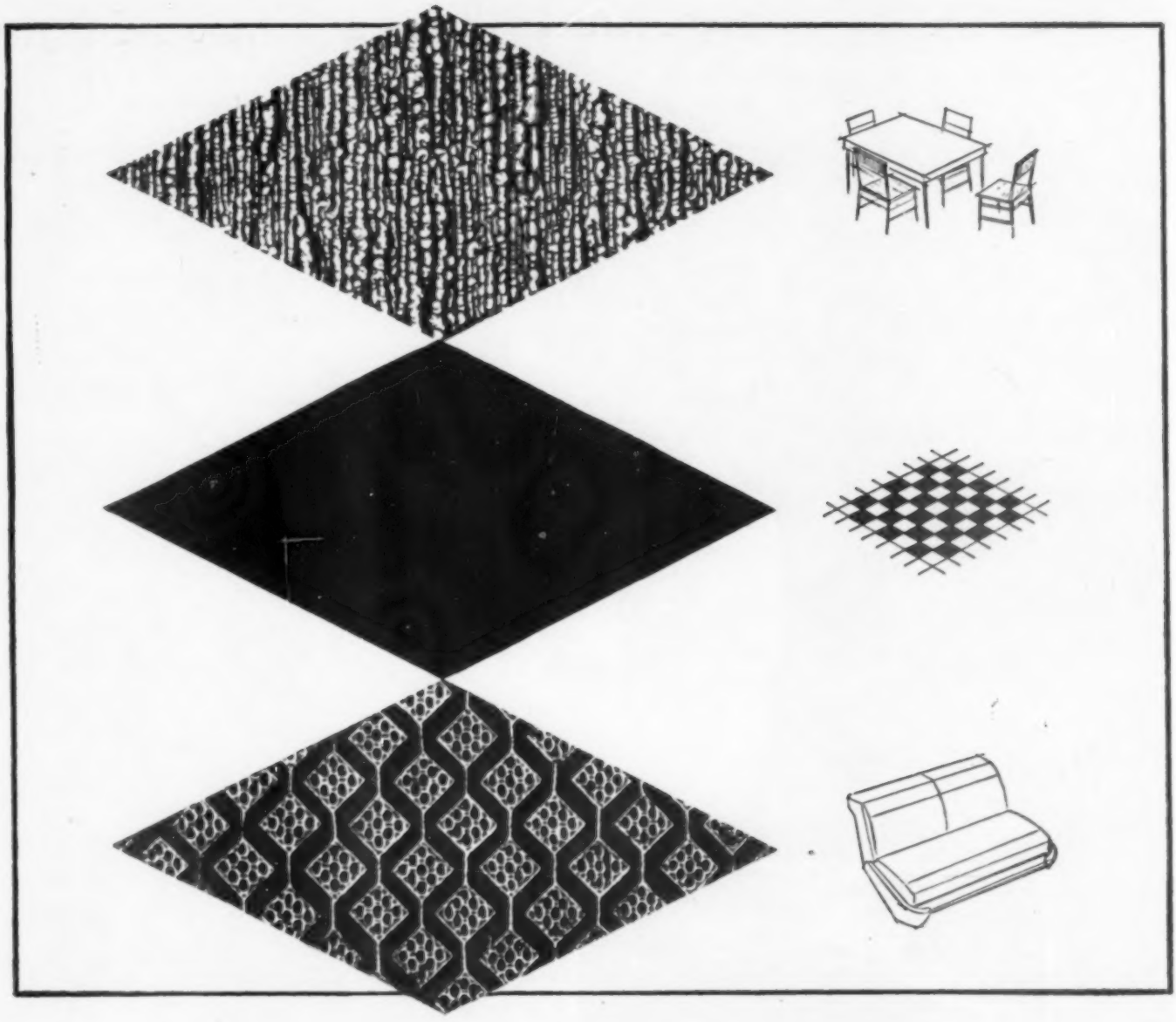

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Carew Tower, Cincinnati 2, Ohio
Please send 32-page Emeryfacts describing the Plastolein Plasticizers.

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Company_____

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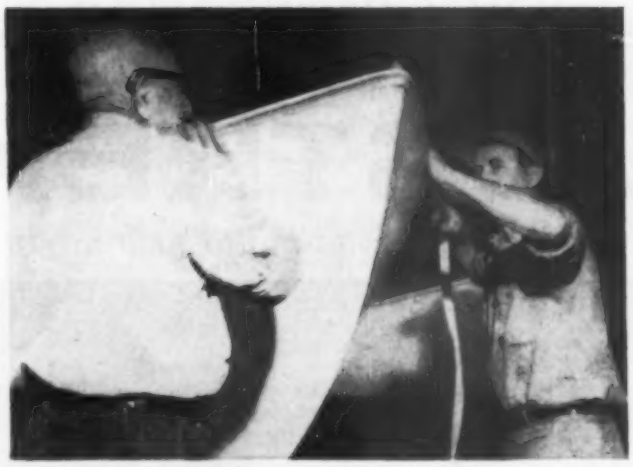
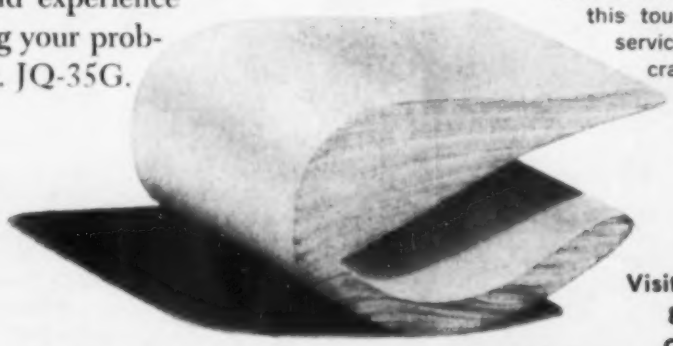


CONTOUR EXTRUDED from BAKELITE Brand Vinyl VFD-9962, this white rub rail for small boats and yachts affords resiliency, abrasion resistance and weatherability unobtainable in materials used previously. Easily applied, this tough, durable protective rail has given service life up to 8 years without checking or cracking. Extruded for Cape Cod Shipbuilding Co., Wareham, Mass., by The Rex Corporation, West Acton, Mass.



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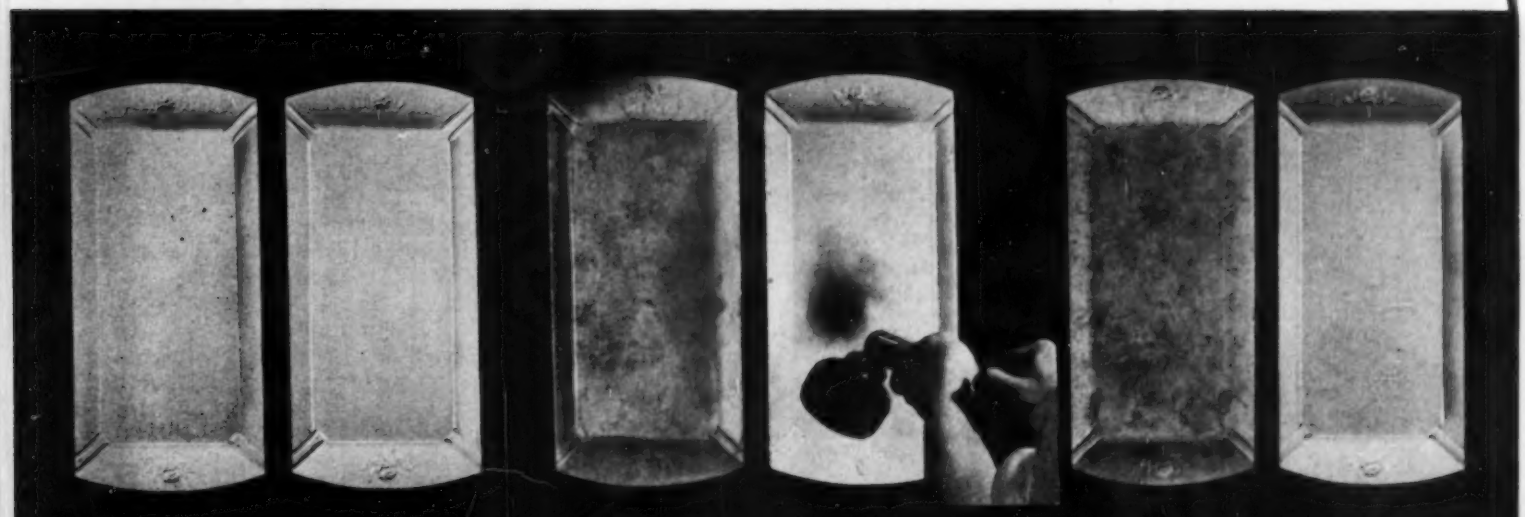

1. Two trays from same mold. Left: molded of standard material. Right: molded of Lustrex Lo-Stat.

2. Charcoal dust is sprayed on both trays.

3. Result! Dust pattern on standard tray corresponds to static electric charge. Tray of Lustrex Lo-Stat is practically clean. The little charcoal remaining is easily tapped off.

Think what Lustrex Lo-Stat can mean in keeping housewares clean and appealing, how much longer signs, displays and packages will stay attractive. Air conditioner and fan grills are other moldings that will be improved. There are dozens of jobs that Lustrex Lo-Stat dust-resistant styrene can do better. And production economies include the elimination of spraying and bathing; open storage and simplified handling. Lustrex Lo-Stat is in full production. Send for a trial quantity now along with complete technical data. Monsanto Chemical Company, Plastics Division, Room 362, Springfield 2, Mass.

Monsanto

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PLASTICS TECHNOLOGY

OCTOBER, 1958

EDITORIAL: The Eighth National Plastics Exposition

The feature section of this issue of PLASTICS TECHNOLOGY is a special preview of the coming Eighth National Plastics Exposition, being held in Chicago next month. This section consists of a relatively brief editorial description of the show; a special statement by the Exposition Committee chairman; an alphabetical listing of the exhibitors; a detailed classified list of the exhibits; a floor plan of the exhibit area; and a preliminary program for the SPI Annual Conference, being held during the Exposition mornings.

Stressing the Exposition theme of "Profits Through Plastics," the feature section is designed to make your visit to the show less time-consuming and more valuable to you, your company, and, in turn, to the entire plastics industry and its customers.

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Based on information given in the preview section and through direct contacts with exhibitors, we are confident that the coming Exposition will continue the trend shown by its more-recent predecessor shows toward plastics as true materials of engineering. As such, plastics will be shown in engineering applications, both consumer and industrial types. It will continue the trend away from plastics only for pretty or glamorous items where the colorfulness of the plastic material was used primarily to disguise its inability to meet the service requirements of the part. In its most pleasant terms, this was "Let the buyer beware!" or "Let's fool the buyer, it's easy!"

As we all know, this philosophy no longer prevails. The buyer, even the lay buyer, no longer says, "Plastics are so pretty and colorful, the new item must be better than its predecessor!" Now, however, the layman is much more logical in his thinking. He expects the plastic material to be satisfactory, but is more critical of the resultant item to determine whether it will meet his requirements even better than do others. The word, "plastics," no longer is the kiss of death.

Plastics now suffer the onus of all other engineering materials, including metals and others. In judging any new plastics (engineering) product, the customer thinks only of price and his need for the product. He expects the plastic material, as he would any other engineered material, to be satisfactory.

Note Our New Address!

At the end of this month, Bill Brothers Publications, which includes PLASTICS TECHNOLOGY, are moving to new and larger quarters at: 630 Third Avenue, New York 17, N. Y.

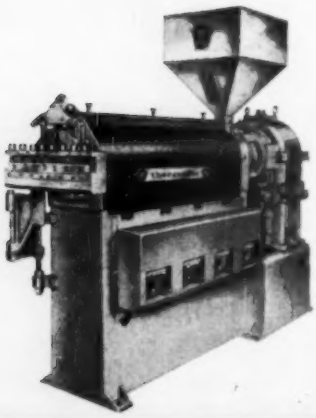
Please stop in to see us and talk over any problems, and hear about our plans for the coming year. We plan 1959 to be our fifth year of growth and value to you, our readers!

Arthur M. Merrill

Editor

SIZE for SIZE

A New thermatic Series* extruder will outproduce any extruder on the market



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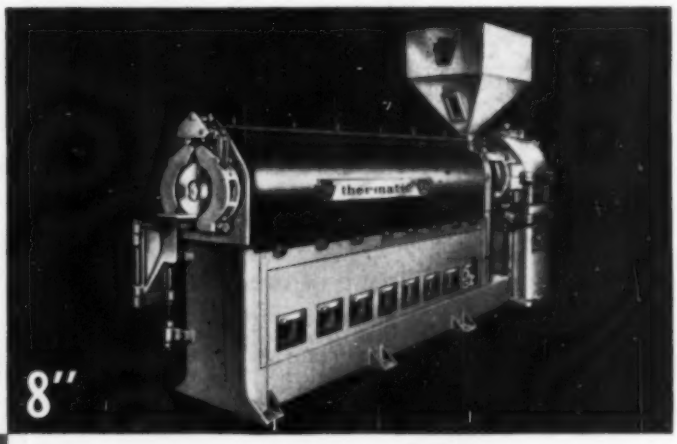

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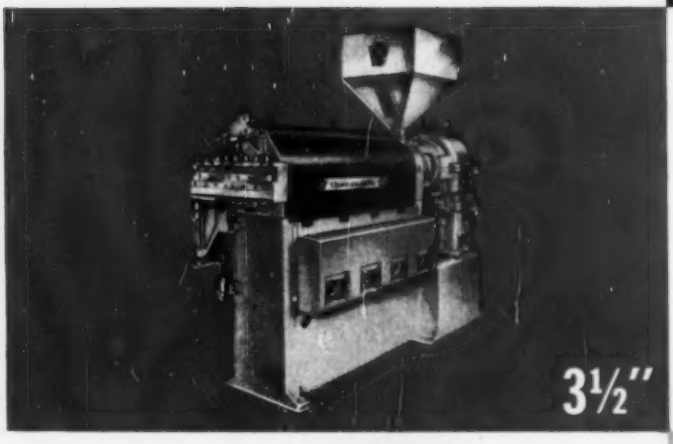

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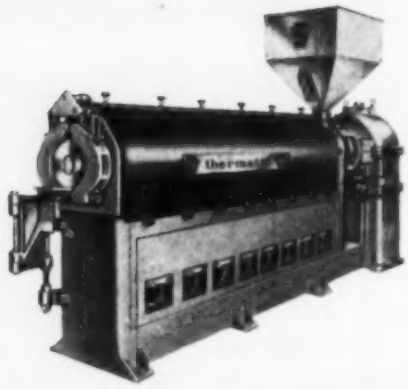

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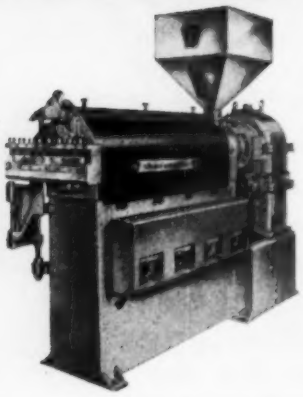

2½"

	2½"	3½"	4½"	6"	8"
More Horsepower Capacity	84	107	142	209	308
Higher Screw Speeds	200	150	110	85	60
Greater Output (lbs./hr.)*	200	375	600	900	1500

*PE (20,000 mol. wt., 4.0 melt index, 0.92 sp. gr., 500°F., 3000 p.s.i)

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NEWS in BRIEF

Cellular or foamed plastics production in 1958 is expected to reach 50,250,000 pounds, an increase of 59% over 1957. The foams involved include vinyl, urethane, polystyrene, phenolic, and polyethylene. Flexible and rigid vinyl foams are expected to account for a million-pound gain over 1957, but only 10% of the predicted total. A five million-pound gain for foamed styrene to 20,000,000 pounds is expected. Flexible and rigid urethane foams should more than double their production to a total of 12,000,000 pounds.

The space age is bringing renewed popularity of phenol-formaldehyde plastics, one of the oldest plastic types known. When used in combination with silica fibers, phenolic resins are proving to be the only known material capable of withstanding the frictional heats (over 10,000° F.) to which missile nose cones are subjected when re-entering the atmosphere.

Russian plastics industry stands out in instrumentation, quality of personnel, plant housekeeping, and use of continuous operation principle, but has only limited availability of top-grade processing equipment, according to the U.S.A. plastics industry team that recently visited the U.S.S.R. Russian compression molding plants were of top quality, possibly due to the emphasis on industrial goods, rather than consumer goods, and production took place in plants having at least 150 presses. The extent and quality of plastics research work also impressed the visiting team favorably.

Everyone in the plastics field has plenty to tell the people, says Betty Lou Raskin, Research Associate in the Radiation Laboratory, John Hopkins University (see Guest Editorial, page 917). The public wants to know how to shop for plastics more wisely, how to make better use of plastics products they already have, information on the materials, and some information on the scientists and engineers who make them possible. As Miss Raskin says, it's high time that we do tell the people!

Business developments in the plastics industry were varied in nature. A new affiliate, Carlew Chemicals, Ltd., formed jointly by Cary Chemicals, Inc., and its Canadian sales representatives, Lewis Specialties, Ltd. Celanese Corp. of America and Imperial Chemical Industries, Ltd., announced the formation of a jointly-owned subsidiary, tentatively named Lindun Fibers Co., to produce Teron polyester fiber in the U. S. The fiber will be produced in both staple and filament forms. Texas Eastman plans to produce polypropylene in its Longview, Tex., plant, using a process developed at Tennessee Eastman's research laboratories.

New Materials worthy of attention (see pages 948-50): adhesive for bonding vinyl compounds to nylon or polyester-fiber fabrics; high-strength, contact-pressure, epoxy adhesive; high-density, extrusion-grade polyethylene; two-component, thermoset coating for foamed polystyrene; low-viscosity, fast curing polyester resin; line of expandable polystyrene beads; flame-resistant phenolic-paper laminate; flexible enamel finish for linear polyethylene and polypropylene moldings; light-colored styrene graft polymer; and dense, precipitated calcium carbonate filler for alkyd and resin emulsion paints.

New Equipment of special interest (see pages 952-3): portable lifter for barrels; tensile testing machine operating at constant-deformation rates; controlled circulation-type steam generator; heavy-duty, cylindrical electric oven; reciprocating ram extruder for Teflon; series of solenoid valves; and coating and rotary drying components for a flow-coating system.

Plastics Applications to be noted (see pages 954-9): wind tunnels of modified styrene; slide viewer with urea housing; butyrate with aluminum foil trim; portable, marine battery box of molded polyester; combination mixer-, blender-, meat grinder-, knife sharpener-fruit juicer with molded melamine bowl; bicycle speedometer of acrylic; and PVC shipping tubes for petroleum core samples.

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Hercules polypropylene

Switch to Pro-fax, the versatile new plastic with a combination of properties never before available in a single material, and watch your profits grow.

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Combined with all these functional advantages unique in this new thermoplastic, Pro-fax has strength, rigidity, good surface hardness and excellent color and finish in a low-cost plastic that lends itself to low-cost production by a variety of processing methods.

Complete data on product and mold design available on request. Call or write:

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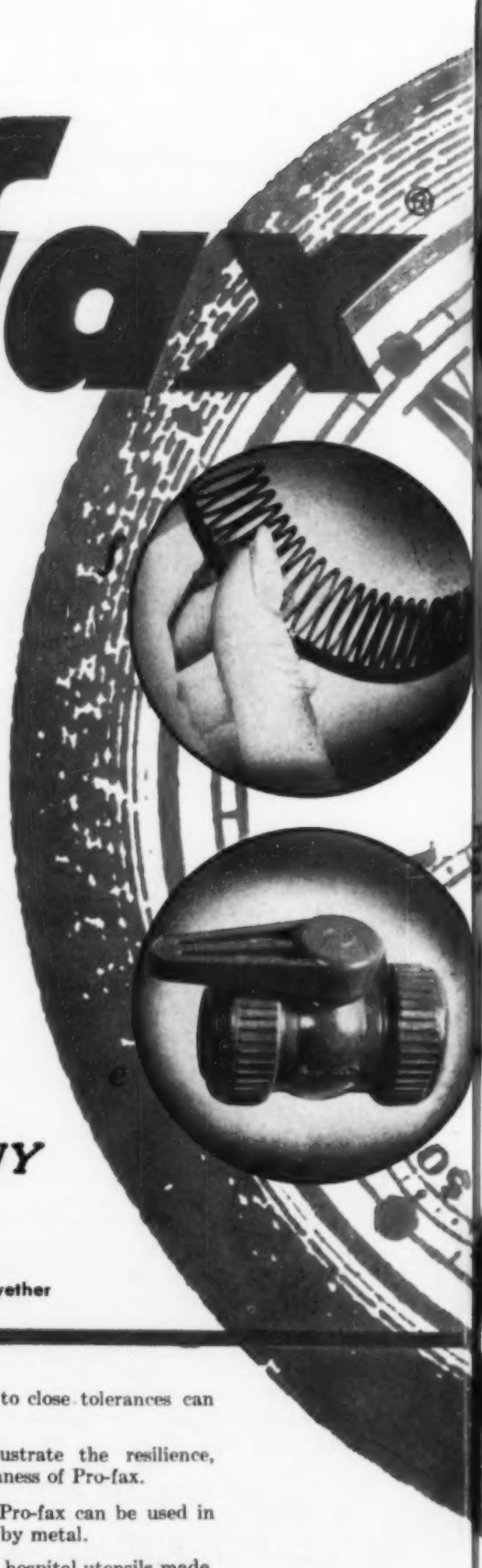
THREE NEW MATERIALS FOR THE PLASTICS INDUSTRY
Hi-fax® High-density polyethylene • Pro-fax® Polypropylene • Penton® Chlorinated polyether



a PACKAGING FILMS based on Pro-fax have excellent tear and tensile strength; are heat sealable and have good printability.

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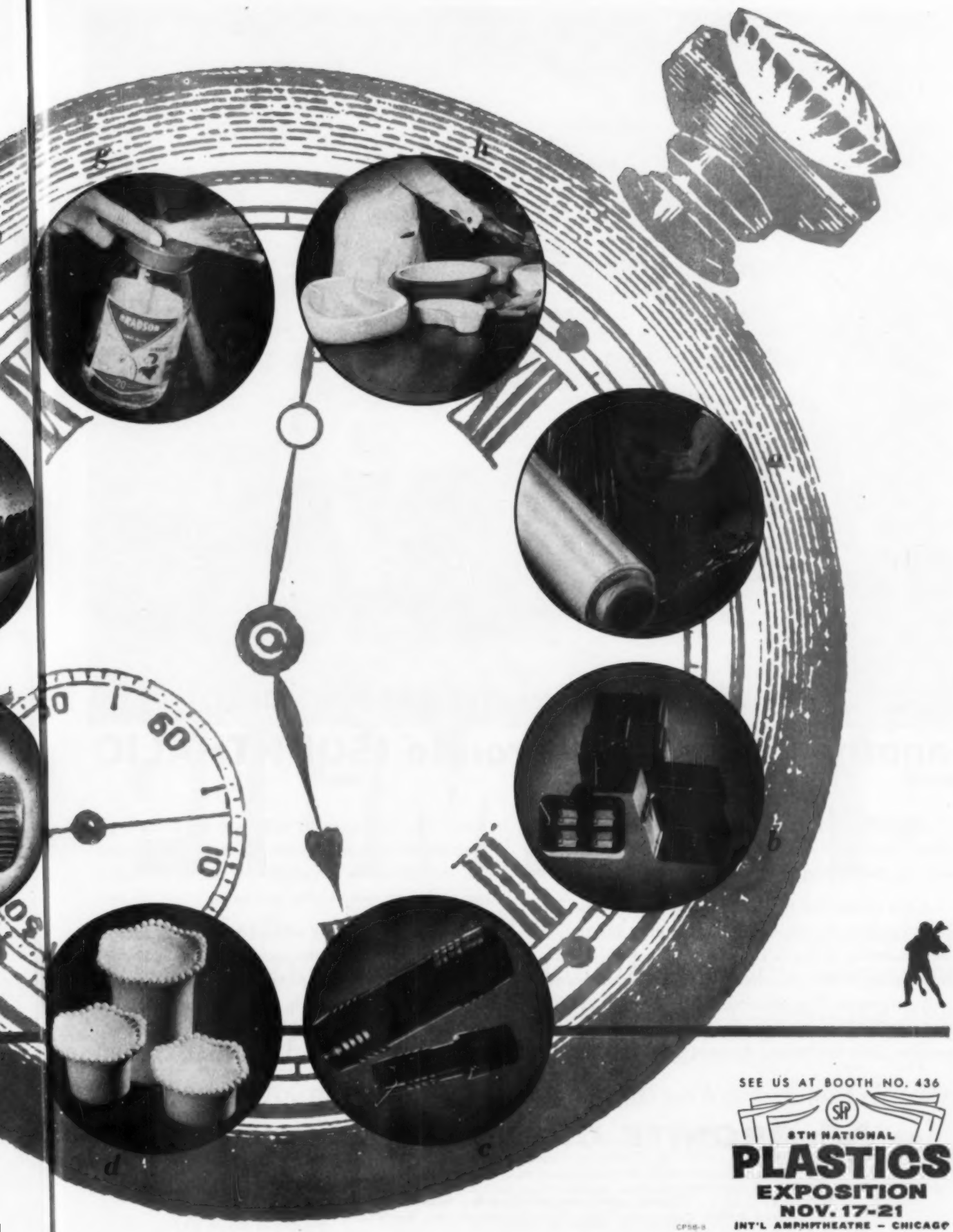

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NOV. 17-21

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CP58-9

Unique new lightweight truck which can carry a seven ton payload over all types of terrain. The high-strength plastic cab is made with a resin based on Oronite Isophthalic.

Tough, lightweight plastic cab another FIRST for Oronite® ISOPHTHALIC

This unique cargo transport, manufactured by the Albee Rolligon Company, represents the first commercial production of a wheel-less, "off-road" truck.

A big reason for the truck's off-road efficiency is due to its light weight—only 7000 pounds. The major weight-saving factor is the use of a fiber glass reinforced plastic cab made with a new Isophthalic-based polyester resin. The plastic cab is extremely strong and durable, yet weighs only 450 pounds, approximately 1000 less than a conventional steel cab.

Isophthalic polyester resins, with their high strengths are continually solving tough application problems, providing the reinforced plastic manufacturer with new, year-ahead products.

Learn how Isophthalic polyester resins can benefit the products you manufacture or market. Contact Oronite directly for complete information. Oronite can also put you in touch with suppliers of high-strength Isophthalic-based laminating resins.

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QUALITY Glidden PRODUCTS

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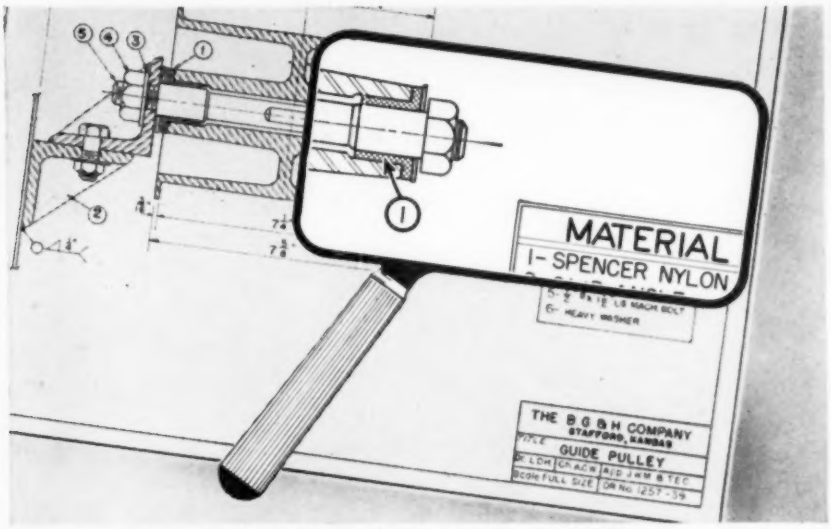
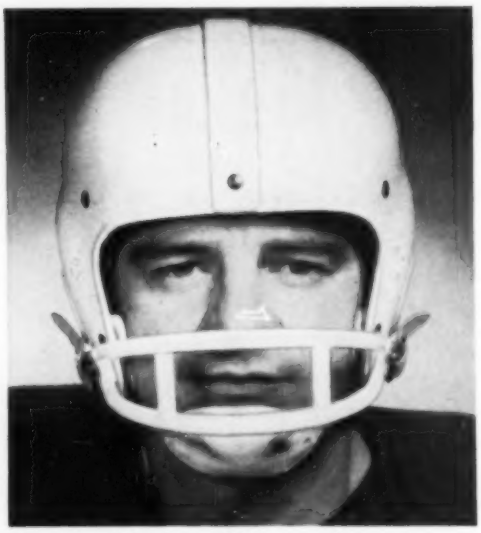
Chemicals—Pigments—Metals Division
Baltimore 26, Maryland



Here is a typical engineering application of Spencer Nylon, a bearing application. Because Spencer Nylons absorb shocks that shatter many other plastics and metals, they are often ideal for use in bearings, valves, and other high speed parts. For example, Line Scale Co. of Oklahoma finds pipeline valves of Spencer Nylon hold up under speeds that would pit brass. And, when one side gets worn, you can turn it over and use the other side.



More flexible than old-type nylons, Spencer Nylon 402 makes possible the easy-fitting Marietta football face guard. Metal-tough, even thin guards give good protection. Yet Spencer Nylon (density 1.14) has less than half the specific gravity of aluminum.

Reports from 4 manufacturers:

"Why I Specify SPENCER Nylon":

Special properties of SPENCER Nylon often outmode metals and other plastics . . .

Specific Spencer Nylons have properties that other materials, including old-type nylons, don't have. In recent months these special properties have won many assignments for engineering applications, and enthusiastic praise from satisfied users. Here are some of the reasons why:

"Spencer Nylon outperforms other nylons in gear applications," says Molding Jobbers, Inc., of Minneapolis. "The first nylon we tested failed under tension. But Spencer Nylon 401 ran as high as 90 ft. lbs. in a torque load test requiring 60 ft. lbs." Another important advantage in gear applications is the fact that nylon is largely self-lubricating.

In tough situations—such as in a connection for pumps and tanks—R&K Tool and Die Company finds that pipe fittings made of high impact plastics sometimes give way under vibration strain. Metal is objectionable on the grounds of expense and corrosion. But pipe fittings made from Spencer Nylon 401 are completely satisfactory.

Pounds instead of ounces! Because processability of Spencer Nylon is superior to that of old-type nylons, it is now possible to make far larger injection-molded pieces. Broad molding temperature range assures proper cavity fill and ease of control.

Also, Spencer Nylons are unaffected by most solvents and dilute mineral and organic acids, allowing for a wide range of uses.

You, too, may find that the special properties of one of Spencer's wide range of nylons offers a better solution to your materials problem. For complete information write: Spencer Chemical Company, 605 Dwight Bldg., Kansas City 5, Mo.

"We couldn't burst-test Spencer Nylon 401 pipe fittings," reports R&K Tool and Die Co. of Cleveland. "Our testing apparatus gave out first." Extra toughness of Spencer Nylon makes it ideal for pipe fittings. Also, Spencer Nylon can be milled, drilled, taped, turned, cut and otherwise machined.

"Far easier to mold than the first nylon we tried," says Ray Hodges, molder of nylon wheel bearings. "Cycle time is decreased, and we get fewer rejects." And Spencer Nylon 401 cuts materials costs 70%. Also, the "give" in Spencer Nylon enables it to overcome minor inaccuracies in alignment not possible with steel.

SPENCER NYLON

SPENCER CHEMICAL COMPANY
General Offices • Dwight Building
Kansas City 5, Missouri

SPENCER

RCI EPOTUF Epoxy Resin

"An ideal resin for potting applications"

says J. R. McRobert, vice president, Novi Equipment Company

Engine heat, vibration and road shocks present problems that must be met and mastered in auto air conditioning equipment. And the Novi Equipment Company, Novi, Michigan, has found that an RCI EPOTUF epoxy resin plays a vital role in the manufacture of its air conditioners — successfully seals a copper coil component in the steel magnetic compressor clutch — insuring dependable performance.

"The use of EPOTUF allows a very close tolerance with a permanent, rigid seal that prevents copper-steel contact — and the 'shorting out' that would thereby result," explains Mr. McRobert. "EPOTUF is the ideal resin for our purposes, possessing excellent qualities of adhesion with the exact electrical properties we require."

Manufacturers everywhere are finding increased use for Reichhold's versatile epoxy resins. EPOTUF epoxies offer rugged strength, corrosion resistance and superior bonding properties that have proven perfect for a variety of applications.

And when you do business with RCI, you can count on fast, on-time deliveries anywhere in the country. Why not let *us* know *your* epoxy requirements?

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Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
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More Than 100 Years Of Know-How

of the Engineering Staff at Modern Plastic Machinery Corporation are represented in the new "CENTURY SERIES" of Extruders available in screw sizes from 1" to 8" diameter

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At modest cost you receive:

- Air-cooled cylinders.
- Xaloy 306 liners in all sizes—1" to 8".
- High speed, high horsepower, high pressure (10,000 psi working pressure).
- High-thrust bearing capacity.
- Long bearing life.
- True bearing ratings.
- Over-size herringbone gear transmissions in 2½"- 8" sizes.
- 16:1—20:1—24:1 Length/Diameter ratio cylinders (measured from front of feed opening). (Special lengths on request.)
- Vented cylinders, hoppers or screws.
- Interchangeable band heaters, cast-in heaters, induction heaters.
- Easily replaced cylinders.
- Complete packages fully wired for low cost installation.

A full line of valves, pressure gauges, dies and other accessories are available.

MPM AIR-COOLED PLASTIC EXTRUDER
Model No. EF-250-20

MPM Extruders are available in screw sizes of 1" — 1½-2" — 2½" — 3½" — 4½" — 6" — 8" with cylinders of 13.1 — 16:1 — 20:1 — 24:1 — LE/D Ratio — with or without vents

MPM Model No.	ESF-100-12 EF-100-12	EF-250-20	EF-350-20
Screw Diameter	1"	2½"	3½"
Le/D Ratio	12:1	20:1	20:1
Heating Load—Watts	1800	12,750	25,000
Heating Zones	2	4	4
Gear Ratio (Standard)	20:1	23.8:1	24.9:1
Transmission HP at 75 RPM	.45	28	37
Type Gears	Worm	Herringbone	Herringbone
Thrust Bearing Capacity Dynamic Load Rating	11,750#	215,000#	400,000#
B-10 Life at 75 rpm	4,000 hrs. at 5,000 psi 32,000 hrs. at 2,500 psi	27,000 hrs. at 10,000 psi 216,000 hrs. at 5,000 psi	25,200 hrs. at 10,000 psi 201,600 hrs. at 5,000 psi
Motor HP	.5	15 - 25	25 - 30
Screw Speed (Standard)	8-80 rpm	7-85 rpm	7-85 rpm
Output per hour	6-12 lbs.	85-135 lbs.	200-250 lbs.
Cooling System—Cylinder	None	Air	Air
Cooling System—Hopper	Water	Water	Water

Note: B-10 Life —
See Anti-Friction Bearing Mfg. Assoc. Stds. Specifications for other size Extruders on request.

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"The new look in
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Beautiful, lightweight, unbreakable,
plastic jars, molded from

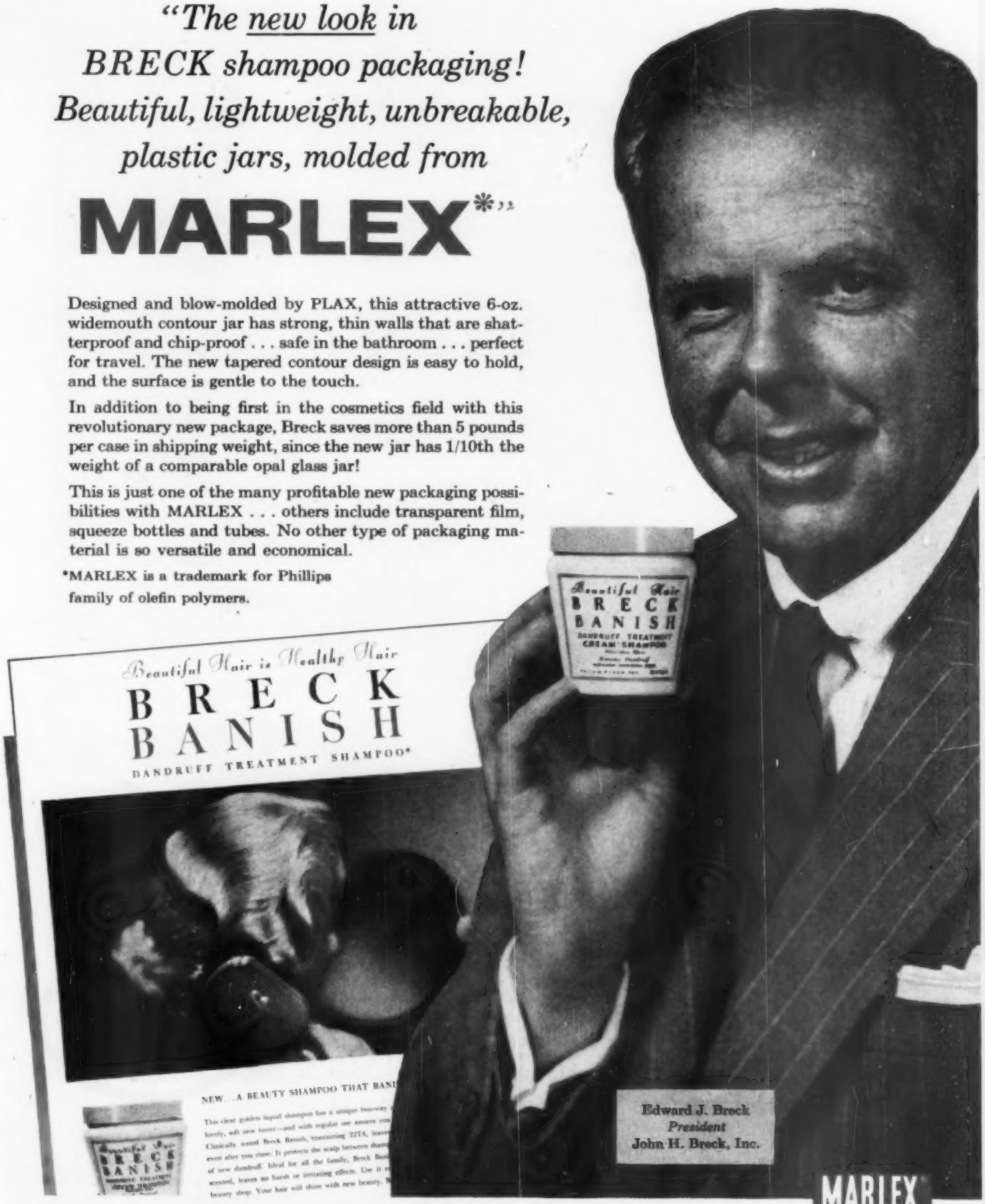
MARLEX*"

Designed and blow-molded by PLAX, this attractive 6-oz. widemouth contour jar has strong, thin walls that are shatterproof and chip-proof . . . safe in the bathroom . . . perfect for travel. The new tapered contour design is easy to hold, and the surface is gentle to the touch.

In addition to being first in the cosmetics field with this revolutionary new package, Breck saves more than 5 pounds per case in shipping weight, since the new jar has 1/10th the weight of a comparable opal glass jar!

This is just one of the many profitable new packaging possibilities with MARLEX . . . others include transparent film, squeeze bottles and tubes. No other type of packaging material is so versatile and economical.

*MARLEX is a trademark for Phillips family of olefin polymers.



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When quality is important to your finished product, insist on Enjay Isooctyl and Decyl Alcohols.

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Specially formulated for corrugated reinforced plastic sheeting...

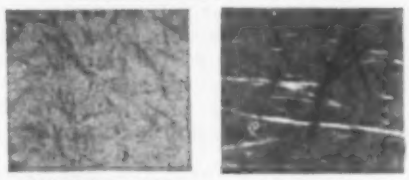
GLIDPOL 1001-LS polyester resin system offers greater resistance to sunlight, weathering!

GLIDPOL 1001-LS is recommended for manufacturing reinforced plastic sheeting for skylights, awnings, windows, fences, windbreaks and other products exposed to direct sunlight and weather. This light-stabilized, medium viscosity resin has excellent initial gloss and color; offers maximum resistance to fading and discoloration (see proof at right).

When diluted with Styrene or Methyl Methacrylate, GLIDPOL 1001-LS possesses all of the desirable liquid resin, gelation and curing properties. It permits rapid wetting of glass fibers, and responds to regular peroxide and hydroperoxide catalysts. Where direct sunlight is encountered, dilution with Methyl Methacrylate will improve the resistance to weathering and extend the service life of any product by reducing the surface erosion and fiber blooming.

Ready-to-use GLIDPOL 1001-LS resins, pre-pigmented with light-fast colors, can be custom-formulated to meet your requirements. Write for details.

AFTER 24 MONTHS EXPOSURE



GLIDPOL 1001-LS | Resin "A"

Photograph (reduced to one-half actual size) taken after 24 months exposure to Florida sun shows little change in reinforced panel containing GLIDPOL 1001-LS diluted with Methyl Methacrylate. Marked discoloration, surface erosion and fiber blooming resulted when panel made with Resin "A"— diluted with Styrene only—was exposed same length of time.

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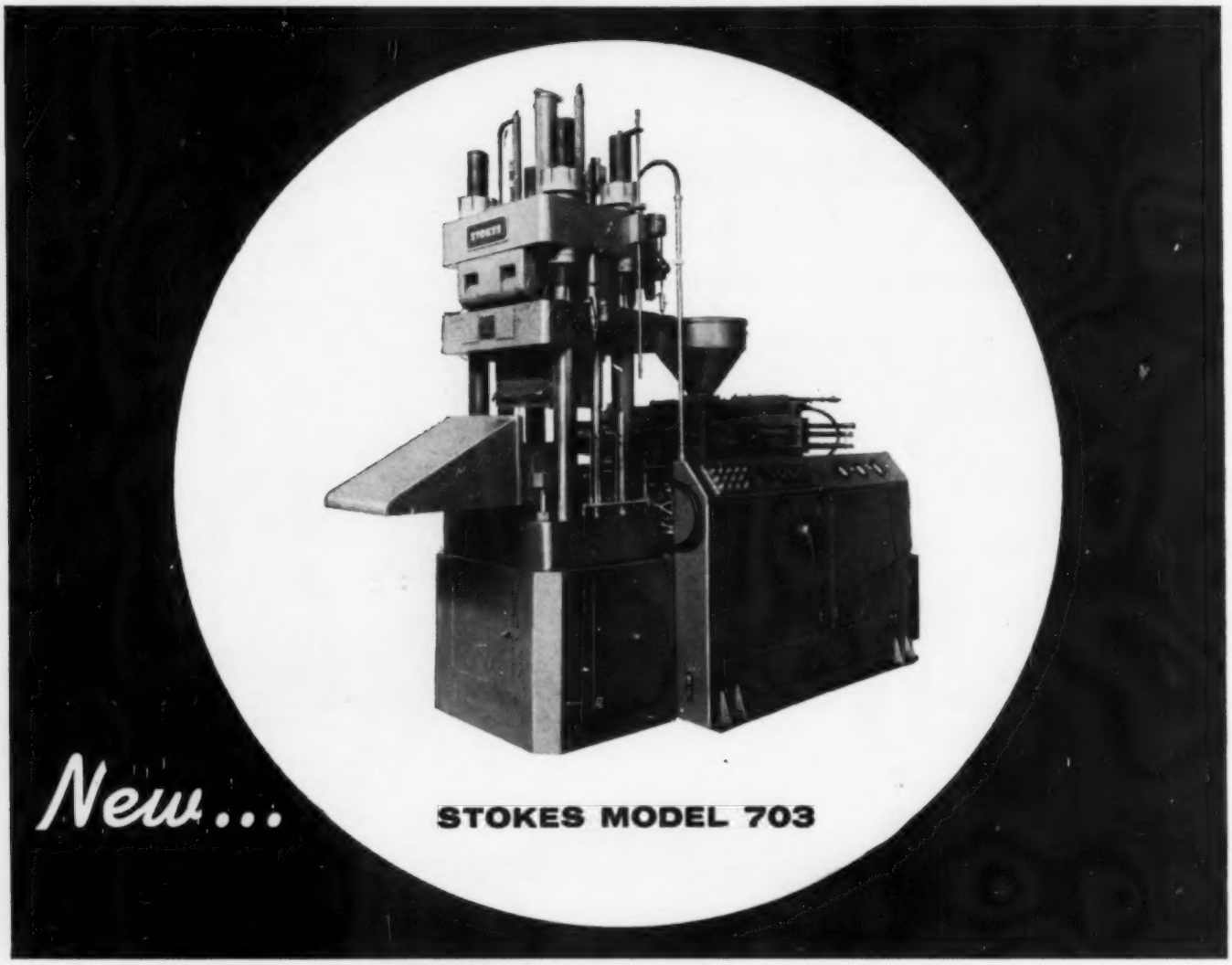

The Truly Automatic 6-ounce Injection Molding Machine

The new Stokes Model 703 is the first machine of 6-ounce capacity to offer truly automatic injection molding to producers of larger parts such as auto tail lights, radio cases, fountain pen barrels, and similar pieces. It provides fast, economical production of big parts, yet is readily adaptable to smaller parts.

The 703 takes full advantage of its vertical design, combining vertical clamping with horizontal combing. Degated parts can be ejected into chutes, or deposited on a conveyor oriented as they were molded. Set-up and change-over is easy and quick—floor space is conserved—the mold is at an efficient working height.

All thermoplastic materials, including nylon, can be molded in the 703. An independently actuated positive nozzle shut-off prevents drooling. It also permits pre-packing the injection cylinder, precompression of the material at high pressure and faster filling. Center-point adjustment of the head insures keeping it absolutely level, preventing cocking of the mold. Automatic lubrication reduces wear and insures trouble-free service. Low pressure and controlled-speed closing provides greater safety to the mold—final clamping is fast, and at full pressure. Push-button type valves on the gages prolong their life.

Technical information and application data is available. Stokes Engineering Advisory Service will assist in the application of the new 703 to your own production needs. Call—or write—today.

SEE IT AT THE SHOW—Booth #101, National Plastics Exposition

Plastics Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

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PVC PEARLS

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- Cut down on "Rejects"
- Help Produce a better Product

AND
SAVE YOU MONEY

HELP YOURSELF TO THESE BENEFITS NOW

HERE'S WHY WE SAY
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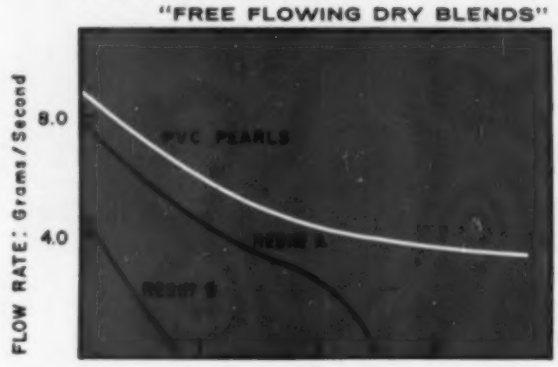

Compare the flow rate of Escambia PVC Pearls at various plasticizer levels with conventional resins ("Resin A" and "Resin B") in the chart above. (Tests made through 60° stainless steel funnel having a ½-inch opening.)

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FOR MORE INFORMATION read "Dustless PVC Eases Processing" an article appearing in the June 1958 issue of Modern Plastics Magazine. If you missed this discussion of the advantages of this unique new polymer, order reprints below.

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Relative Ratings of Low-Temperature Vinyl Plasticizers

(10 = best, 0 = poorest)

	Dioctyl Iso-sebacates	Diiso-octyl Iso-sebacate	Octyl Seba-cates	Octyl Aze-lates	Octyl Adi-pates	Diiso-decyl Adi-pate	Dioctyl Phthalate (blending material)
Compatibility (roll spew)	6	5	6	7	9	5	10
Strength: tensile, modulus, elongation	7	6	7.5	7.5	8	7.5	9
Low Temp.: stiffness, brittle point	7.5	7.5	8.5	8.5	8.5	7.5	3.5
Stability: heat and light	8	8	7	8.5	7	6.5	8
Extraction: water, soap soln.	8.5	8.5	9.5	7.5	4.5	6	8
Extraction: oil (vegetable, mineral)	3.0	4	2	1	1	3	7
Volatility (carbon)	7	7	8	6.5	2.5	7	7
Relative Rating	47	46	48.5	46.5	40.5	42.5	52.5
Approximate Price Index* (Isosebacates = 100)	100	100	135	105	90	90	65

*Based on current (Aug. 1958) prevailing prices for finished plasticizers

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Octyl esters of the new U.S.I. ISOSEBACIC Acid have been evaluated against accepted vinyl plasticizers in a complete series of tests at the U.S.I. laboratories. The performance results, expressed as relative ratings above, have been coupled with current price indexes to show comparisons which are meaningful to the maker of vinyl plasticizers. Here are the conclusions:

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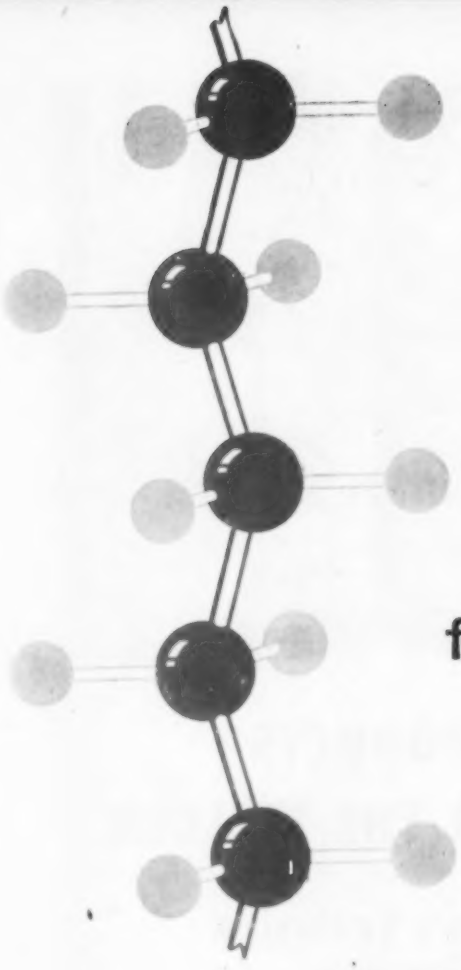

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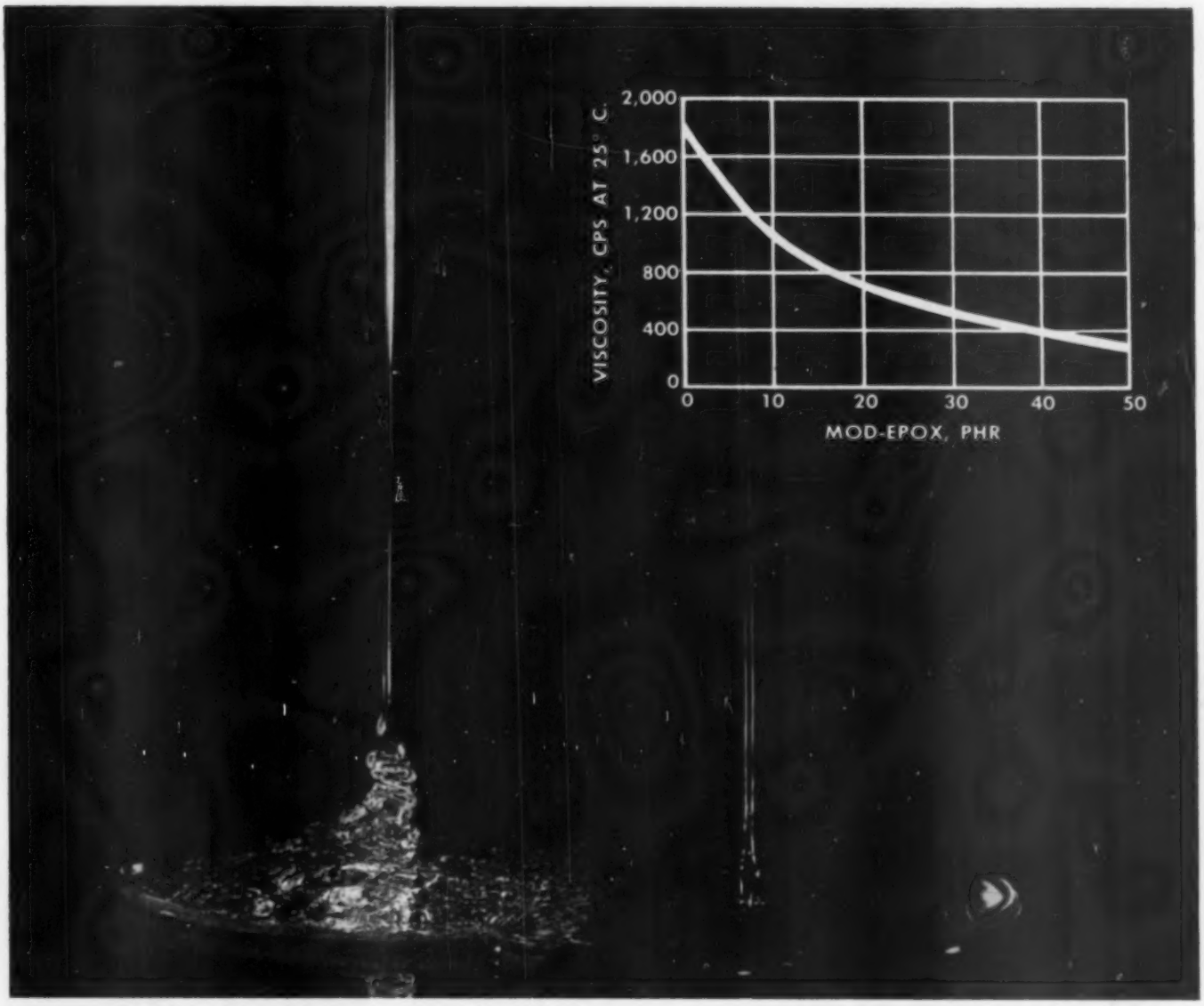

See how new Mod-Epox (in the compound at right) lowers viscosity of a typical unmodified epoxy resin formulation (left).

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PRODUCERS of plastics resins and compounds and fabricators of plastic shapes and forms are becoming increasingly aware that the molecular size and structure of the polymer and its building block, the monomer, are as important as their chemical composition. Today, the plastics industry is able to produce the polymers with almost any molecular weight and form, thereby improving on nature in some cases.

The fabricator of plastic articles from polymers is aware that as molecular weight increases, certain desirable properties of the end-product increase, but processing becomes more difficult. Thus, the plastics processor is obliged to compromise between end-product characteristics on one hand, and the process workability of the plastic on the other. To determine the correct balance, the plastics fabricator must measure the optimum molecular weight allowable while maintaining satisfactory process performance and economics.

In the phonograph record industry, for example, a typical copolymer in use is 87% vinyl chloride and 13% vinyl acetate. Because of the conflicting demands of workability, record fidelity, resistance to heat in the channels of distribution, and non-breakability, however this copolymer is not usable unless its molecular weight is controlled. Record manufacturers know that a copolymer of 87% vinyl chloride and 13% vinyl acetate is best if it has a K-value (molecular weight) indicative of approximately 50 corresponding to a relative viscosity of 1.65, as measured in a 1% solution of the copolymer by the dilute solution viscosity method.

The determination and control of molecular weight, be it in terms of K-value or relative viscosity, therefore, is very important to the plastics processor. There are a number of methods for this determination: (1). Viscosity of dilute solution; (2). Osmotic pressure; and (3). Light scattering. However, the simplest, most direct, and most meaningful method for molecular weight determination is the C. W. Brabender Plastograph.

Dilute Solution Viscosity Method

The determination of molecular weight by this method is carried out in a very dilute solution of the

Walter T. Blake was born in Missouri in 1914, and attended M. I. T., receiving a B.S. in Business and Engineering Administration in 1937. From 1937-41, he was in research for Lever Bros. Co.; from 1941-46, he served with the Army Ordnance Research & Development staff; from 1946-57, he was director of research and development for Pillsbury Mills, Inc.; and since 1957, has held his present position as vice-president and general manager of C. W. Brabender Instruments, Inc. He holds the position of Colonel in the Army Officers Reserve Corps, and is an active member of the American Association for the Advancement of Science, the Institute of Food Technologists, the American Management Association, the American Ceramic Society, the A.C.S., Phi Lambda Delta, and others.

Mr. & Mrs. Blake have two daughters, and reside in Ridgewood, N. J.

polymer in a suitable solvent, such as cyclohexanone. The method is based on the fact that the viscosity of a plastics solution depends on both the concentration of the polymer and the molecular weight of the polymer. If the concentration is kept constant, therefore, the viscosity of the solution depends solely on the molecular weight.

To eliminate the influence of the solvent, the "relative viscosity" (Vr) is calculated by dividing the viscosity of the solution by the viscosity of the solvent. The K-value, or molecular weight, therefore, can be determined from the following equation:

$$\text{Log Vr} = \left(\frac{75\ K^2}{1 + 1.5\ KC} + K\right) \cdot C$$

where Vr is the relative viscosity; C is the concentration, in grams of polymer in 100 cubic centimeters of solvent; and K is a constant related to molecular weight.

From this equation, which is not only difficult to manipulate but valid only for very dilute solutions, the value of K can be calculated. The term "relative viscosity" is more common and is related to "K-value", as shown in Figure 1.

Molecular weight also is frequently referred to in terms of "specific viscosity" (Vs) which is determined from the following relationship of the different viscosities (V) involved:

$$\text{Vs} = \frac{\text{V (solution)} - \text{V (solvent)}}{\text{V (solvent)}}$$

Plastograph Method

The dilute solution method described above for the determination of the molecular weight of polymers is very exacting and time-consuming. This method of testing also has the disadvantage of giving the plastic processing engineer indicative values only, because he does not work with 1% polymer solutions.

The plastic processing engineer wants to know how much deformation power, expressed in a system such as foot-pounds per second, he must use when he processes a polymer having a relative viscosity of 2.0, or how low a K-value he should select in order to achieve as high an output as possible at a given power input and still insure the quality of his finished product.

All these questions are answered in less than one-half hour by the Plastograph method. This method measures molecular weight by measuring the deformation power on the C. W. Brabender Plastograph. In addition to establishing molecular weight, the deformation power of the plastic gives indication as to the amount of work required on the processing equipment.

The Plastograph makes it possible to measure and record the deformation power characteristics of thermoplastics continuously at temperatures typical of those used in processing (up to 300° C.). A high degree of correlation exists between the torque requirements for deformation power and the material's molecular weight.

In one experiment, the deformation power of a compound composed of 60 parts polyvinyl chloride and 40 parts dioctyl phthalate was measured and recorded during the shear mixing in the Plastograph's Banbury-type, jacketed-roller measuring heat at 160° C. and 56 Rpm. The only variables in this experiment were the K-values of the polyvinyl chloride samples. The deformation power achieved a plateau after approximately 20 minutes, and torque at the plateau for each sample correlated well with K-value, as seen in Table 1 and Figure 2. The relation between deformation power and molecular weight was first observed by P. Schmidt in 1950.

A further experiment showed that polyvinyl chloride in the range of practical interest (that is, in the K-value range of 55-80, or relative viscosity range of 1.8-3.3 when measured in a 1% solution of the plastic) shows a linear relationship between the molecular weight (K-value) and deformation power. This can be seen in Figure 3. The conditions of this experiment were identical to the preceding experiment reported in Table 1 and Figure 2.

Table 1. Correlation Between Viscosities and Deformation Power in PVC*

K-Value	Relative Viscosity*	Specific Viscosity*	Deformation Power, Mkg./Sec.
65.2	2.27	1.27	0.71
69.5	2.48	1.48	0.90
70.0	2.50	1.50	0.90
72.0	2.63	1.63	0.96
73.7	2.74	1.74	1.00
80.5	3.30	2.30	1.30

* Solution of one gram PVC in 100 cubic centimeters of solvent.

The method of testing is extremely simple. It yields reproducible values with high correlation to those obtained by the complex dilute solution viscosity method. The optimum testing time is 30 minutes, in contrast to the 5-24 hours required for the viscosity method. The linear relation between deformation power and K-value continues to exist with other proportions of polyvinyl chloride and plasticizers at other test temperatures and shear rates.

Applications

Process Problems

The simple, exact method of molecular-weight determination with the Plastograph is applicable to many process problems. For example, three different mixtures consisting of 70 parts polyvinyl chloride and 30 parts dioctyl phthalate, 60 parts polyvinyl chloride and 40 parts dioctyl phthalate, and 50 parts polyvinyl chloride and 50 parts dioctyl phthalate were tested in the form of plastisols and in the form of foil processed from the plastisol at 170° C. in order to determine to what extent the molecular weight of the PVC was influenced during processing.

The measurement of the deformation power by the Plastograph on both the plastisols and processed foils made therefrom showed that the deformation power of the processed foil was reduced. These reductions of the deformation powers, see Table 2, are caused by depolymerization of the materials. Thus, a very simple and rapid test method for measuring and controlling the depolymerization of a polymer of polymer mixture is now available by measuring deformation power with the Plastograph.

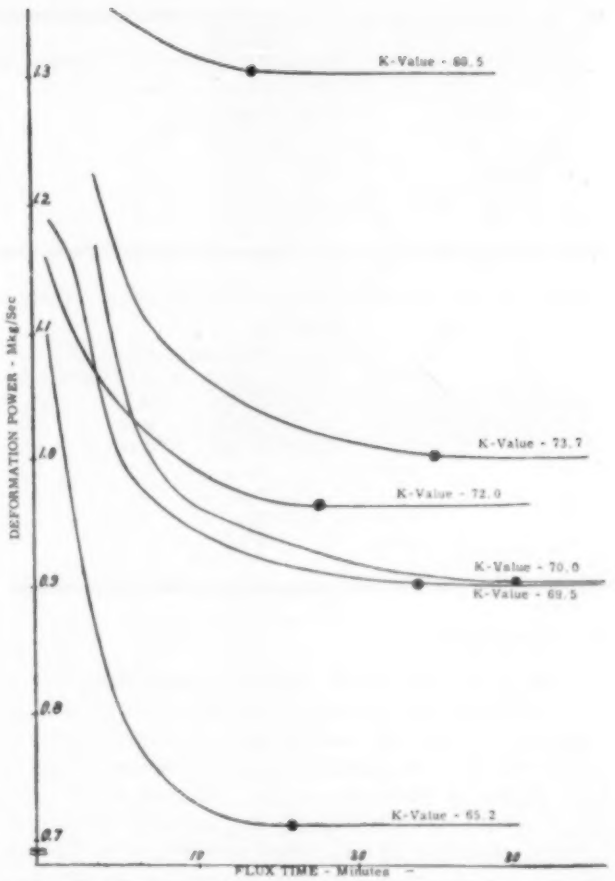

Fig. 2. Effect of Flux Time on Deformation Powers of 60/40 PVC/DOP Mixtures of Differing K-Values Measured in the Plastograph at 160° C. and 56 Rpm.

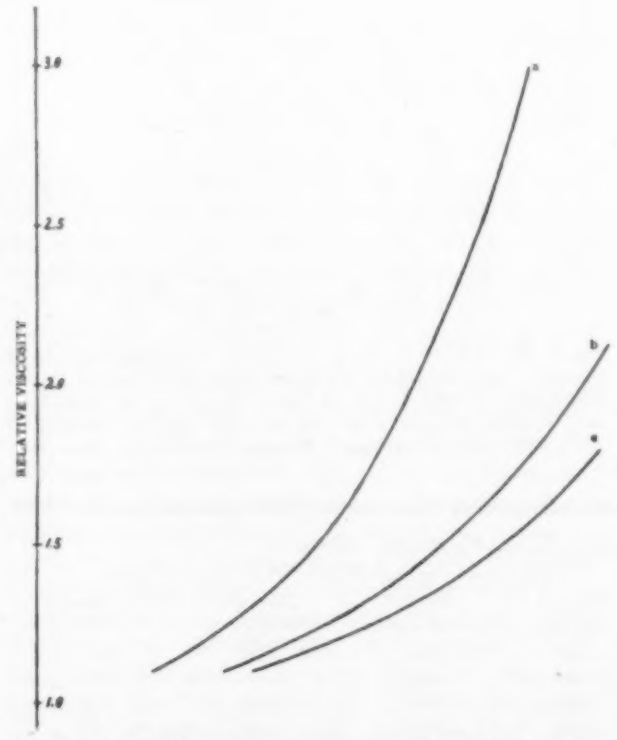

Fig. 1. Relative Viscosity as a Function of K-Value for Three Solvent Solutions of PVC (1.0, 0.5, and 0.4 grams of PVC in 100 cubic centimeters of solvent).

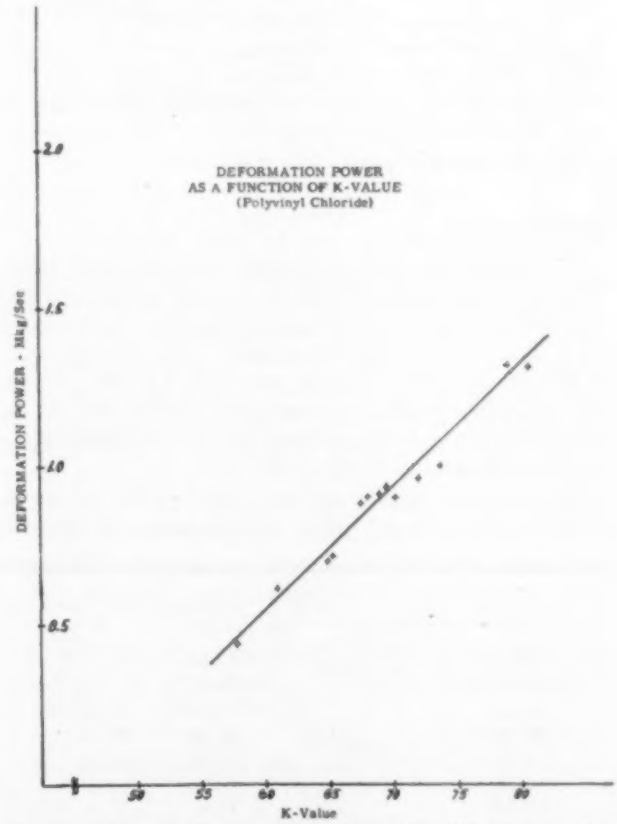

Fig. 3. Deformation Power as a Function of K-Value for a 60/40 PVC/DOP Mixture Measured in the Plastograph at 160° C. 56 Rpm.

Table 2. Deformation Powers of PVC Plastisols and Processed Foils

PVC/DOP	Deformation Power, Mkg./Sec.		K-Values			
			By Dilute Solution Method		By Plastograph Method	
	Plastisol	Foil	Plastisol	Foil	Plastisol	Foil
70/30	1.36	1.20	69.0	65.4	—	—
60/40	0.85	0.78	69.0	66.2	68.0	66.0
50/50	0.45	0.39	69.0	67.5	—	—

Table 3. Deformation Powers of Polyvinyl Acetate Mixtures

K-Value	Approx. Molecular Weight	Deformation Power, Mkg./Sec., for PV Acetate DBP ratios		
		67/33	78/22	89/11
20	20,000	0.01	0.04	0.08
30	37,000	0.05	0.19	0.58
50	73,000	0.31	0.69	1.20
60	—	0.40	—	—
70	170,000	0.86	—	—
90	430,000	1.14	—	—

Polyvinyl Acetate

This novel and simple method of measuring molecular weight is not limited to polyvinyl chloride and its copolymers, but also can be applied to practically all thermoplastics; for example, polyvinyl acetate. Table 3 and Figure 4 show the results obtained when polyvinyl acetate of different K-value was combined with dibutyl phthalate in the ratios of 67/33, 78/22, and 89/11, and 45 grams of each mixture at six different K-values were measured in the Plastograph with its jacketed roller measuring head operating at 56 Rpm. and held constant at 100° C.

As can be seen, deformation power of the Plastograph is more sensitive to changing molecular weight when mixed with small amounts of plasticizer. For measurements of this type of polyvinyl acetate, therefore, a maximum ratio of polyvinyl acetate to dibutyl phthalate appears most desirable.

Polyethylene

The molecular weight of linear (low-pressure) polyethylene ranges from 50,000 to beyond 1,000,000, and its relative viscosity from approximately 1.0 to more than 10.0. At present low-pressure polyethylene with a relative viscosity of approximately 1.0-5.0, with a corresponding molecular weight of 50,000-500,000, is of great interest. Both extremes can be measured without trouble on the Plastograph.

A series of experiments are reported in Figure 5 wherein 40 grams of linear polyethylenes of different relative viscosities were measured in the jacketed-roller measuring head on the Plastograph at 28 rpm. with temperature held constant at 160° C. Stabilizers were added to prevent cross-linking and, thus, add an undesirable new parameter. High correlation exists between deformation power and relative viscosity, and the experiment illustrates how simply and quickly the molecular weight can be measured by the C. W. Brabender method.

In addition, as pointed out previously, much additional value is gained on processing power requirements because the method simulates process conditions. Melt indices by static extrusion rheometer methods (in the case of polyethylene, melt indices are misleadingly low) are obsoleted by the Plastograph. A companion chart

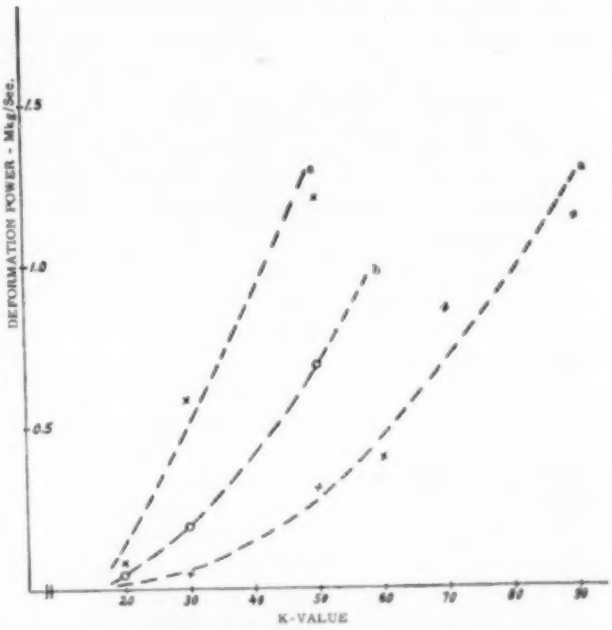

Fig. 4. Deformation Power as a Function of K-Value for Three Polyvinyl Acetate/Dibutyl Phthalate Mixtures Measured in the Plastograph at 100° C. and 56 Rpm. Legend: (a) 67 parts Polyvinyl Acetate/33 parts DBP; (b) 78 parts Polyvinyl Acetate/22 parts DBP; and (c) 89 parts Polyvinyl Acetate/11 parts DBP.

(Continued on page 930)

Table 4. Deformation Power of Nitrocellulose-Plasticizer Mixtures

Sample Designation	Nitrogen Content, %	Deformation Power of (40/60) NC/Plasticizer Mixes			
		Dioctyl Phthalate	Dibutyl Phthalate	Dihexyl Phthalate	Butyl Benzyl Phthalate
HP-15	11.88	0.02	0.42	0.59	0.62
HP-25	11.98	0.09	0.48	0.63	0.64
HP-35	12.02	0.13	0.64	0.68	0.70
HP-50	12.10	0.15	0.69	0.78	0.74
HP-600	12.02	0.18	0.89	0.84	0.90
HP-1200	12.09	0.18	0.98	0.90	1.03

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Creep Characteristics of Laminated Epoxy Plastics

Results of tests show effects of cure conditions, hardener content, and additives on creep properties.

THE creep characteristics of laminated epoxy plastics have been the subject of considerable attention during the past year, particularly because of the increasing responsibility given to these materials in the design of structural parts for marine, architectural, automotive and aircraft uses and in the fabrication of precision tooling.

Because of the many cure variables and material formulation variables to be explored in these creep tests, it was necessary to select a testing procedure that would provide significant data in a relatively short period of time, without the many hours necessitated by more-conventional tests. For this reason, the simple cantilever beam creep-measuring apparatus was selected as the most likely to offer effective data. Creep characteristics using this apparatus have been reported by the author and others in earlier papers (1, 2)*, though valuable contributions on creep have been made by others using tension creep and creep in flexure (3, 4, 5). Goldfein interpreted creep data of earlier reports, calculating creep properties from modulus of elasticity data at higher temperatures (6).

In the current series of tests, a four-inch test span was selected and test specimens, one-half inch wide and 0.125-inch thick, were standardized. Dead weights were suspended from the end of the beam; the weights computed to yield various maximum fiber stresses at the points of support, according to well-known formulas for simple cantilever beams. Measurements were made manually with a depth gage, and deformation read to the nearest thousandth of an inch. Zero readings at no stress (other than weight of test specimens) were established, and the immediate deformation noted on addition of load.

This permitted a calculation of the modulus of elasticity that was compared with the instantaneous recovery after removal of stress, permitting a check on experimental data. In most tests, the following cycle of readings was observed:

(1). Deformation of 60 seconds after load is applied.
(2). Deformation in one hour.

* Numbers in parentheses refer to Bibliography at end of article.

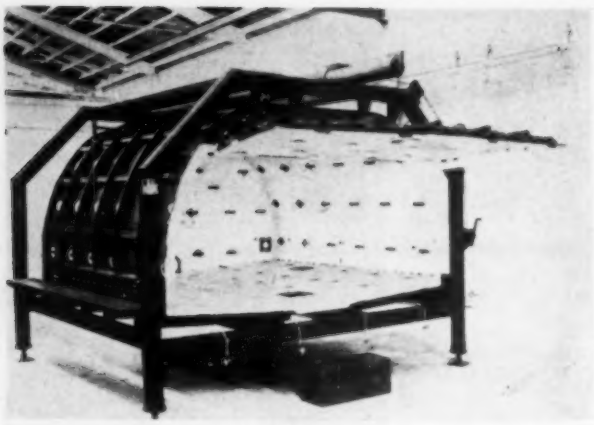

Fig. 1. Fuel cell checking fixture of glass-reinforced epoxy.

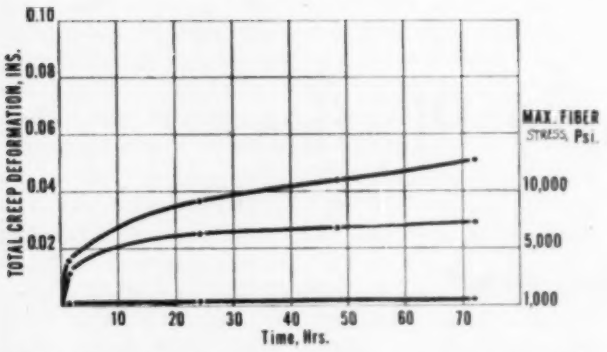

Fig. 2. Effect of maximum fiber stress on long-term creep deformation at 72° F. of full-cured epoxy laminates.

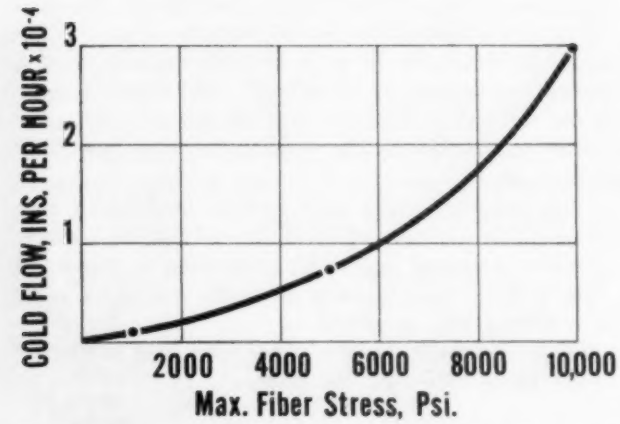

Fig. 3. Slope of straight-line portion of cold flow-fiber stress curve as a function of maximum fiber stress at 72° F.

(3). Deformation in 24 hours.
(4). Deformation in 48 hours.
(5). Deformation in 72 hours.
Load is removed,
(6). Recovery in 60 seconds.
(7). Recovery after one hour.
(8). Recovery after 24 hours.

There was additional recovery beyond the last 24-hour interval, although the data was significant enough to terminate that particular test by that time. Differences between the 24-hour recovery measurements and the initial (zero load) readings were taken arbitrarily as measures of permanent set in the test specimens. Likewise, in most instances, the ultimate slope of the deformation-time curve was established, and an enlightening picture of cold flow ascertained. Temperatures were recorded at frequent intervals, but were not maintained other than through the thermostatic control of heat supply to the laboratory area. Most of the tests were conducted in the 70-80° F. temperature range.

Epoxy laminates were selected for this study because they are the most recent of the laminating resins to receive industrial attention, particularly in structural applications. Several proprietary formulations produced by Furane Plastics were among those reported in these tests, as well as certain material variables (such as the influence of reactive diluents on creep characteristics, and the influences of fillers and hardeners). However, the important subjects of cure variables and the influences of stoichiometric proportions of curing agents for room-temperature curing systems were studied.

The selection of glass cloth samples posed a basic problem because glass, too, introduces variables into the creep studies. Standardized for this test was a wide open-mesh glass fabric (i.e., HG-63 or type 1500) that contained a much higher resin weight (46-50%) than is possible with the conventional glass cloth (no. 181) for aircraft structures. Ultimate strengths are lower, although the influence on creep properties of resin variables was more distinct during testing when using an open-mesh glass fabric. The glass selected for these tests is widely used in the manufacture of precision laminated plastic tooling (see Figure 1). Volan A finish was used on the glass cloth. Lay-ups with the resin were conducted manually, the assembly placed between glass plates, and hand clamps employed to compress the six-ply glass laminate to the ⅛-inch stops placed on the plates. Cure was conducted at room temperature and augmented, where indicated, by post-cure at 200° F. Curing agents involved polyamines, as well as proprietary safety hardeners produced by Furane.

Selecting a fully cured and post-cured laminated epoxy resin, various maximum fiber stresses were developed on the simple cantilever beam, according to the well known formula:

$$\text{Modulus } (E) = \frac{W l^3}{3Id}$$

where d = deflection at point of loading (creep measurements made here after initial deflection under load);
l = length of beam;

W = weight; and
I = movement of inertia

Test Results

The results are shown in Figure 2 over a 72-hour time interval, and show more rapid creep and cold flow at greater stresses. Initial deformation under load is not illustrated. In consequence of these and many other tests, 10,000 psi. maximum fiber stress was selected as both a convenient and severe stress for revealing creep characteristics. The ultimate flexural strength of most of the subject laminates was in the range of 32,000-33,000 psi. The flexural deformation temperatures, according to ASTM tests for the room-temperature curing epoxy resin systems used, were in the range of 170-230° F. Figure 3 shows the slope of the straight-line portion of the curve (ds/dt) as a function of maximum fiber stress at 75° F.

Effect of Cure Conditions

Room-temperature setting epoxies may exhibit considerable creep as indicated by flexural strength even though they ostensibly are cured. This observation is quite evident in Figures 4 and 5 showing data for an epoxy laminate prepared from a typical room-curing laminating resin (Epocast 2G and Hardener 9810). Flexural strength tests and creep tests commenced simultaneously after different intervals of cure time. In 10½-hours of room-temperature cure, the laminate had reached a room-temperature flexural strength of 24,000 psi.; and in 18 hours reached the ultimate strength of 32,000 psi. On the other hand, the magnitude of the creep was very much greater at 10½ hours than at 18 hours. Data in Figure 4 does not lend itself to easy interpretation because the resin simultaneously is creeping and curing after the load has been applied. The curves concerned only with creep characteristics do not show the initial 60-second deformation that contains the elastic deformation of the material. The order of magnitude of this initial deformation ranges from 0.800-inch for a partly cured 10½-hour specimen to 0.500-inch for a fully cured specimen.

In Figure 5, the ordinate values indicate the time-dwell at room temperature before stress is applied (up to 144 hours). The creep measurements in one and 24 hours are shown after waiting from 10½-144 hours at room temperature. The advantages of waiting for an adequate length of time before stressing is imperative for good performance and dimensional stability. Another significant data observed for most room-temperature curing epoxy resin laminates is the advantage of post-cure at 150-200° F. to reduce creep. The lower creep characteristics, as consequences of this post-cure, are shown in Figures 4 and 5. For precision structures, the additional post-cure appears most desirable.

Effect of Hardener Content

We expected at the start of these tests that the percentage of hardener would have a decided bearing upon the creep characteristics, and this proved to be the case. In general, optimum (lowest) creep occurred in the vicinity of the stoichiametric rate of curing agent to epoxy resin. So clear-cut was this observation, that

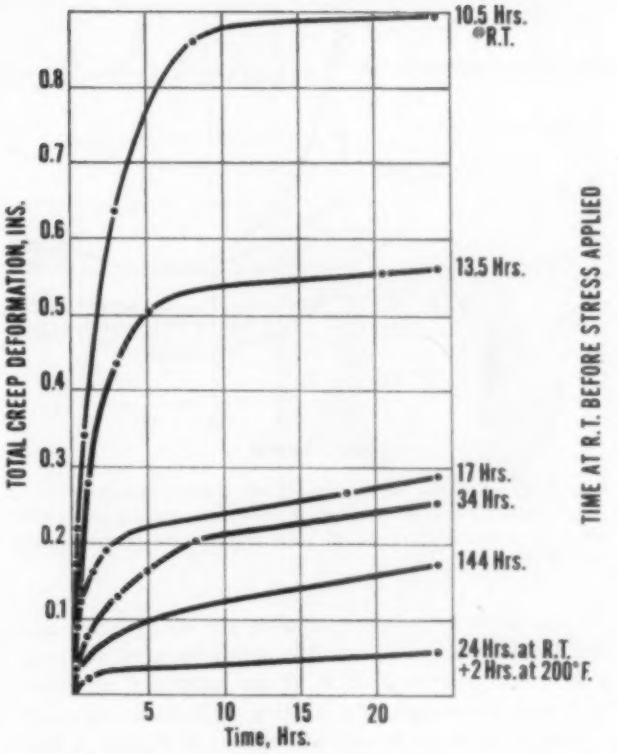

Fig. 4. Effect of conditioning time at room temperature on time vs. total creep deformation for room-temperature setting epoxies.

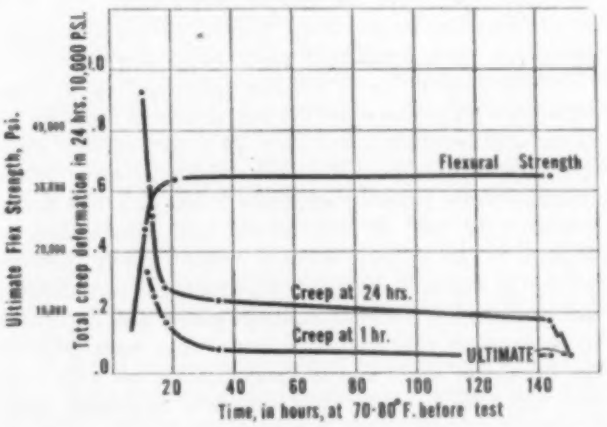

Fig. 5. Effect of time-dwell at room temperature on ultimate flex strength and total creep deformation at 10,000 psi. fiber stress.

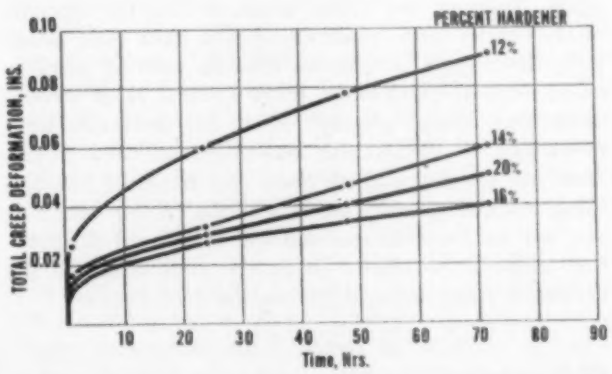

Fig. 6. Effect of hardener content on total creep deformation for a full-cured epoxy laminate at 10,000 psi. fiber stress.

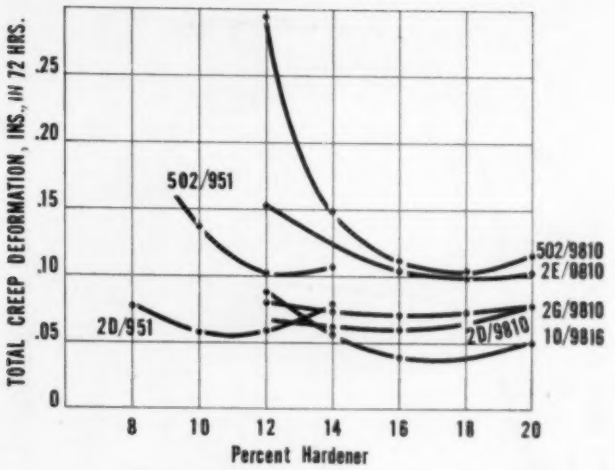

Fig. 7. Effect of hardener content on creep characteristics of various epoxy/hardener systems at room temperature and 10,000 psi. fiber stress when cured at room temperature plus two hours at 200° F.

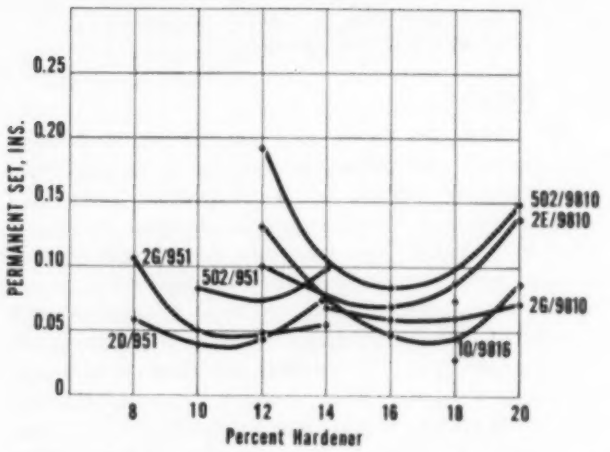

Fig. 8. Effect of hardener content on permanent set of epoxy/-hardener systems at room temperature and 10,000 psi. fiber stress (cured at room temperature plus two hours at 200° F.).

we can suggest that creep studies are an excellent non-destructive method to confirm optimum hardener properties, particularly if it is of an unknown or mixed structure of amines and amides, difficult to calculate.

A typical set of results are shown in Figure 6 for a full-cured epoxy laminate (Epocast 10/HN 9816) with creep characteristics up to 72 hours. Because of the close juxtaposition of the recovery curves for the next 24 hours, they were not plotted. Apparently 16% HN 9816 offers the lowest creep. Similar curves and determinations were conducted upon many room-temperature setting epoxy resins and hardeners, and rather than reproduce all of this data, the end results of creep in 72 hours and permanent set after 24 hours of unloading are shown in Figures 7 and 8. The specimens in all instances were room-temperature cured plus two hours post-cure at 200° F. The curves from which data in Figures 7 and 8 were selected follow orderly patterns similar to Figure 6. It now is apparent that considerable differences exist between different resins and hardeners in their creep characteristics, and it has been possible for Furane to select and to develop materials with very low creep rates using test methods employed here.

Effect of Additives

One further set of data are shown in Figure 9 that again illustrate the creep characteristics of Epocast 10/HN 9816 resin systems to which have been added 10%, by weight, of reactive diluents such as octylene oxide, allyl glycidyl ether, butyl glycidyl ether styrene oxide and phenyl glycidyl ether. All laminates were post-cured. In all instances the creep rates were greater than for the unmodified resin and hardener, though some reactive diluents are less severe in this effect. It also will be observed that the loss in flexural deformation temperature follows almost the same order for the increased creep induced by the reactive diluents.

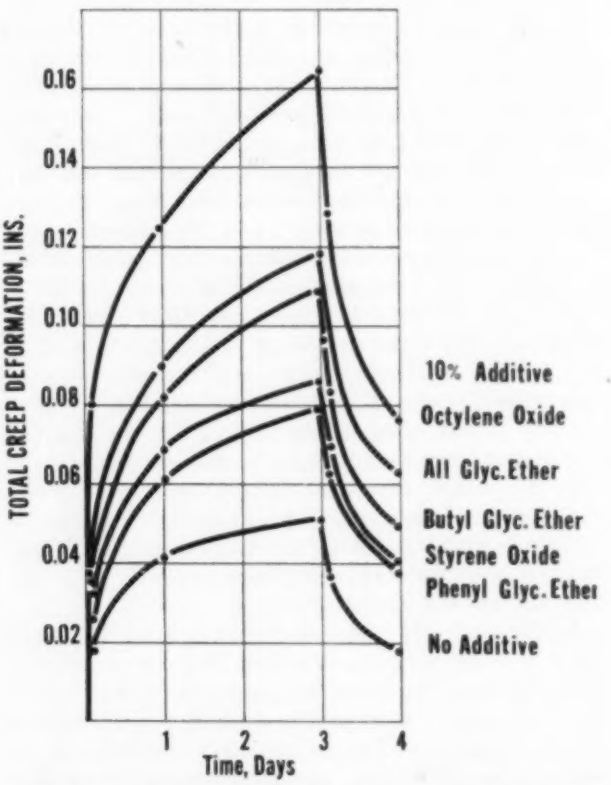

Fig. 9. Effect of 10% reactive diluents on creep data at room temperature and 10,000 psi. fiber stress. (Left portion of curves show creep data commencing one minute after application of load; right portions show recoveries commencing one minute after load removal.)

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—THE END

Guest Editorial

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Let's Tell the People

It's been said that the plastics industry today is where the steel industry was in 1880. Only time will tell if this is true. It is a fact, however, that the industry has a long way to grow—not only in the number of pounds to be produced, but also in the amount of information to be dispensed to the public.

Inquiries have been reaching our laboratory from across the nation. Surgeons, students, teachers, retired military personnel designers, housewives, buyers, and people from many different walks of life are asking us about every imaginable phase of the business—from how to get rich quickly and what is a good glue for patching vinyl wading pools, to which colleges and universities offer graduate courses in plastic technology. Judging from this evidence, the American people want to know, need to know, and have a right to know much more about plastics than those of us in the field are presently telling them.

They are mainly interested in learning how to select, care for, and repair plastics, now that these materials have become a major item in their budgets. The average family in this country is using approximately 100 pounds of plastics a year; about the same amount as it does of natural cheese, oleomargarine and butter combined. This is 10 times more than it used in 1940.

Even though there are now hundreds of different plastic compositions on the market, the consumer knows no more of the fundamental facts about them than she does about the words to the second stanza of our national anthem. She thinks that a plastic is an all-purpose, miracle material which should never break, melt, tear, crack or dissolve. She fails to understand that plastics, like people are of many different types, have individual characteristics, and must be carefully prepared and chosen for the jobs they are to do.

She needs to have information about these synthetics disseminated to her via all of the mass media of communication, especially on the products themselves. Informative labeling is the most direct and the most intelligent way to educate a consumer about plastics. It enables her to learn about them by associating and comparing them with the complete details about their chemical compositions, outstanding features, how to use them, how to take care of them, and what *not* to do to them.

Many of the inquiries which we receive would never have been written if the products in question had been properly labeled at the time of purchase with more than just a catchy brand-name and a glorified list of claims. A Louisville housewife whose clothes hangers melted in her attic told us "I'm sick and tired of finding out the hard way what a plastic won't do."

Quite a few fabricators absolutely refuse to use generic names of the plastics on their lables. Some even go so far as to concoct misleading identifications. For example, an East Coast maker of urethane foam cushions apparently is afraid of the fact that the public does not yet know the word "urethane" as well as it knows the term "foam rubber." He very wrongly labels his product "all new plastic foam rubber."

Omission of safety warning labels by the do-it-yourself and hobby kit assemblers is a far more serious offense. They buy explicitly labeled bulk containers of highly flammable, toxic chemicals, such as polyester resins, organic peroxides, and metallic naphthenates.

(Continued on page 930)

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Neck-In Problem in Polyethylene Extrusion Coating and Film Casting

Investigation shows the necessity for obtaining a favorable compromise between neck-in and draw-down for best practical results.

WHEN polyethylene is extruded from a flat-film die into a nip, as in substrate extrusion coating, or onto a casting roll, as in flat-film casting, the hot melt web will "neck-in" while being drawn down. Neck-in is defined as the difference between the melt web width at the die lips and the coating width at the nip or casting roll. Since the web necks in at both sides, neck-in can be expressed as

$$NI = \frac{W\text{-}L}{2}$$

where NI is the neck-in, W is the hot web width at the die lips, and L is the coated or cast web width on the chill or casting roll (all measured in inches).

When excessive neck-in occurs, "beading" (a thickening of the melt) takes place at both edges of the coating or cast web. Beading causes a loss of coating weight control and results in a hyperboloid-shaped roll during wind-up. In other words, as the roll is wound up, the weight of the coated sheet or film is supported by the two beads, one at each side. This results in a soft roll, sagging in the middle, or possible breaks in the taut edges of the substrate. Such a roll is difficult to use in subsequent converting operations, and much of the sheet is unpredictable in quality at the edges. Excessive neck-in requires the polyethylene coater or film maker to trim the edges of the sheet. Since in extreme cases, the bead may be up to five or six inches on each side, such trimming means a considerable loss of usable web width and material. The greater the neck-in, that in itself is a loss of web width, the greater the danger of beading and possible loss of resin and substrate.

Reducing Neck-In

Because of the interest of extrusion coaters and film makers in minimizing neck-in and beading, our company's Technical Service Laboratory in Tuscola, Ill., has carried out research work on this common and often bothersome and costly condition. The work has established that neck-in is dependent on both machine conditions and basic resin properties. It has also established a number of steps that can be taken to reduce neck-in.

Machine Conditions

As for machine conditions, neck-in mainly is a function of three variables; draw-down distance between the die lips and the chill roll, die setting, and die zone temperatures.

Neck-in occurs in the space between the die lip and the chill roll. Therefore, if this distance decreases, neck-in will decrease. In convention flat-film making, the distance between the die lips and the surface of the quench water bath is very small, and this is the main reason why little neck-in and beading is encountered in this process. In flat-film casting, neck-in decreases rapidly as the draw-down distance decreases; roughly ¼-inch per inch of draw-down distance. Thus, one of the simplest ways to reduce neck-in is to reduce the distance between die lip and chill roll.

Neck-in decreases as the die setting decreases. In one instance, the U.S.I. engineers found that with Petrothene ® 210-27, a resin recommended for both extrusion coating and cast-film making, the average neck-in decreased by 0.4 inch as the die setting was decreased from 20 to 10 mils, all other conditions remaining equal.

Neck-in also decreases when the adapter and die zone temperatures are kept low compared with the barrel zone temperatures. With adapter and die (i.e., melt) temperatures higher than the barrel temperatures, neck-in is high. It decreases increasingly when adapter and die temperatures are lowered gradually below the average barrel temperature.

Figure 1 plotting adapter and die temperature against neck-in illustrates this effect well. In this test with Petrothene 205, (0.924 density, 3.0 melt index) extrusion-coated on kraft paper, the average barrel zone temperature was kept constant at 607° F. When the adapter melt temperature was lowered to 550° F., neck-in on each side decreased roughly from 1.0 to 0.6 per inch.

Neck-in also is reduced, although not significantly, when the extruder screw speed is increased. Coating and casting speeds have only negligible effects on the neck-in of polyethylenes having melt indexes below 9.0, a range which contains all resins recommended by U. S. I. for these two applications. However, it was found that neck-in increased with increasing coater speeds with resins of 22.0 melt index.

Resin Conditions

As for the influence of basic polyethylene resin properties on neck-in, the U. S. I. engineers have found that neck-in increases with density and the logarithm of the melt index. They have shown the following empirical equation:

$$NI = C + 147.7\ d + 2.57 \log MI$$

to describe the relationship accurately. In this formula, C is a constant, d is the hydrostatic resin density in grams per cubic centimeter at 23° C., MI is the melt index, and NI (neck-in) is in inches.

As the melt index increases, the average molecular weight decreases and the resin becomes less viscous. The less viscous the resin, the greater its tendency to neck-in at the sides during draw-down. For this very reason, temperatures at both ends of the die often

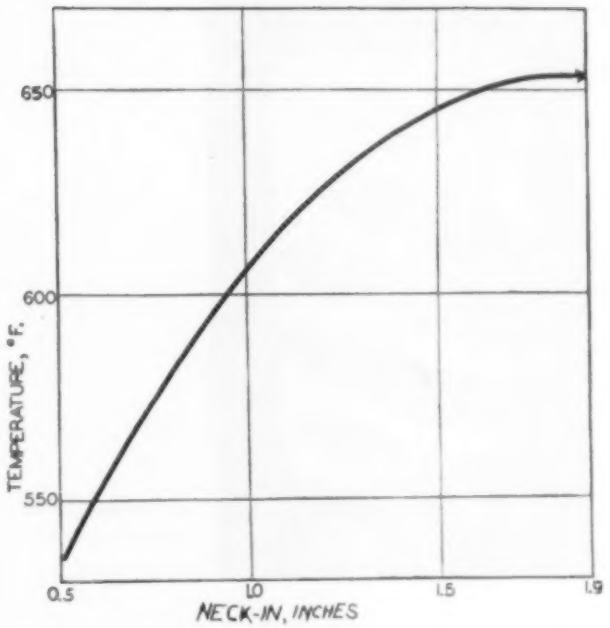

Fig. 1. Effect of temperature differential between extruder barrel, adapter, and die zones on neck-in of polyethylene film.

are kept lower than at its center. For instance, die and temperatures of 570° C., with a die center melt of, say, 600° F., assure that the melt web has a higher viscosity at both sides and, thus, less tendency to neck-in.

Figure 2 shows some results obtained with a specific test carried out in the U. S. I. Technical Service Laboratory in the course of this research. The constant C in the above equation, which represents the sum total of all relevant machine conditions, becomes ±135.9 and, therefore, the above expression for the specific coating or film casting situation in question becomes

$$NI = \pm 135.9 + 147.7\ d + \log MI$$

Figure 2 plots density, linearly, against melt index on a logarithmic scale. Use of semi-logarithmic paper results in the lines of uniform neck-in becoming parallel, straight lines that are equi-distant for equal neck-in differentials. The points on this chart for coating and casting-grade Petrothene types 239 (density

(*Continued on page 927*)

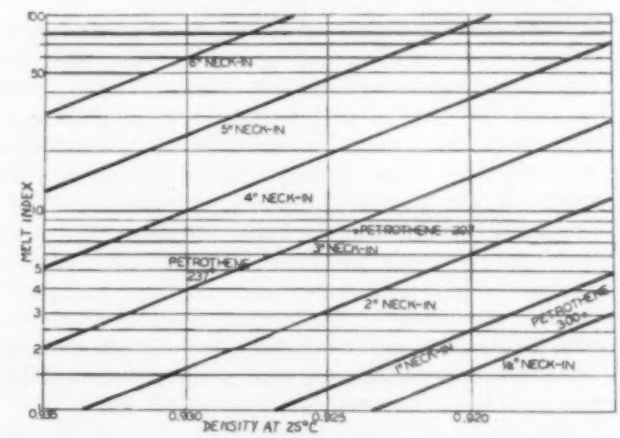

Fig. 2. Effect of polyethylene melt index and density on neck-in.

Paulite phosphorescent tumbler molded in polyethylene.

Christmas tree ornaments glow in the dark.

Luminescence in Plastics

Although most of us know that plastics can be made to glow in the dark, too few of us understand the mechanisms involved, the pitfalls to avoid and, last but not least, the terminology. Luminescence is that phenomenon by which a material has the ability to absorb radiant energy from electromagnetic waves, re-emitting a part of it at longer (visible) wave lengths. Should the material require continuous exposure to the shorter, invisible wave lengths (usually ultraviolet or "black" light) in order to reflect visible light, this phenomenon is more specifically called fluorescence. If, on the other hand, the material continues to glow (at gradually decreasing intensity) after the exciting radiation is removed, we have phosphorescence.

Thus, luminescence is the more general term covering both fluorescence and phosphorescence. How, then, can plastics be made luminescent? This is accomplished through the addition of phosphorescent or fluorescent pigments, which must be non-toxic and compatible with the plastic base material. Resins used to date include acetate, butyrate, styrene, polyethylene, PVC, acrylics, and polyesters. Molding techniques are much the same as for other plastic compounds; however, sprues, runners, and gates should be large enough to permit rapid filling of the cavities. In addition, slightly higher ram pressures of 900-1,000 psi. are recommended in order to provide the best possible surface finish and to seal the pigments into the molded piece.

Phosphorescent plastics glow with an intensity dependent upon the activation, surface area, amount of pigment used, and eye accommodation. The daylight color in most instances is ivory, and the afterglow is blue or green. The latter, while having a higher initial brightness, has only half the life of the blue afterglow (10 hours or more). Obvious applications include flashlights, wall switches, clock and speedometer dials, and lightpulls.

Although there have been both organic and inorganic fluorescent pigments, only the latter are suited to plastics compounding. Specially manufactured sulfides, they derive the fluorescent characteristics from a high-temperature heat-treating process. Formerly available only in daylight opaque colors, they are now obtainable in a wide range of brilliant tones, which take on their added effects when exposed to 3,650 angstrom units (within the ultra-violet spectrum).

As mentioned earlier, the addition of phosphorescent or fluorescent pigments to plastic bases requires practical experience, special equipment, and proper air-clarifying facilities. A Chicago firm, Luminous Resins, Inc., supplies both pigments and custom-tailored molding compounds; phosphorescent, under the trade-name Paulite; and fluorescent, under the trade-name Derbylite.

Two Paulite colors are available, plus 30 Derbylite. It is interesting to note that one of the latter is the only white pigment which will remain pure white when exposed to ultraviolet light. This material is ideally suited for the manufacture of polyester inks for precoating paper, plastic or metal sheets, and silk screening.

—THE END

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Fabricating the Structural Components of the All-Plastic "House of the Future"

A step-by-step discussion of the design components, materials, performance requirements, and operations in making the structural members in the Monsanto "House"

THE phenomenal growth of the plastics industry and its related technology during the past decade has led to a pragmatic realization of the concept of an all-plastic house; an idea that initially had appeared difficult to perceive. The post-war years witnessed a boom in the construction industry, especially housing, resulting in large-scale usage of the traditional building materials in conjunction with a relatively small consumption of plastics. The net effect of this was to stimulate the plastics industry into greater endeavors to obtain a larger share of this potential market. The outlook for the use of structural plastics in housing appeared to be particularly promising, but the artificial barriers against use of a new structural material first had to be overcome.

There has existed a lack of familiarity and technical education on the part of the construction industry regarding the use of plastics as structural elements. A concerted effort toward providing improved data, design know-how, and a better understanding of the potentialities of plastics clearly was needed.

A major step in this direction was the design and construction of Monsanto's full-scale "House of the Future," currently being exhibited at Disneyland, Anaheim, Calif. (see Figure 1). The reason underlying this experimental project were two-fold; to evaluate plastic structural materials, and to show the unlimited uses to which they could be applied. After an extensive testing program to verify the structural analysis and to permit design changes where relevant, Winner Manufacturing undertook the fabrication of the structural plastic components of the house. Other long-term tests still are in process, and undoubtedly will lead to wider knowledge of these materials in future uses.

(Courtesy of Monsanto Chemical Co.)

Fig. 1 Reinforced plastic "House of the Future" after erection at Disneyland, Calif. House has four wings cantilevered from a 16-foot square central core.

Structural Members

The house is cross-shaped, with four curved wings cantilevered from a central core that is mounted on a reinforced-concrete foundation. There are approximately 1,280 square feet of floor area, and the maximum ceiling height is nine feet. The roof over the central core is shaped in the form of a hyperbolic paraboloid with a centrally located apex to mitigate vertical loads.

The basic wing component or "bent" is an 8 by 16-foot outer shell, with each wing having four shells. The two adjacent outer roof shells each contain a ceiling section, while the two lower exterior shells each contain a separate floor panel and a curved stub wall (see Figure 2).

The central core comprises a floor section directly over the foundation and a double ceiling made up of tension and compression panels. In all, there are approximately 170 structural plastic parts involved, as follows:

16 Exterior shells (8 upper, 8 lower).
8 Ceiling shells.
8 Floor panels for exterior shells.
2 Floor panels for the central core.
8 Tension and compression panels.
8 Stub wall panels.
8 Fish plates.
4 Hyperbolic paraboloid roof panels.
15 Miscellaneous plates.
16 Inner skins.
400-feet Miscellaneous angles (3 x 3 x 0.3-inch).

The 16 exterior shells all are shaped identically, except for a difference in trim lines; the lower shells have a deeper box section. The ceiling shells are curved panels that are similar in shape to the upper exterior shells. The 10 floor panels are laminated sandwich structures, and are approximately 17 x 8-feet in size, with a four-inch honeycomb core. The tension and compression panels measuring eight-foot square by 3.4-inches are constructed similarly, using three-inch honeycomb.

The stub walls, 0.3-inch thick, form the panels between the exterior shell floor sections and the half-height of the end wall; the remaining half-wall height being formed by the ceiling shells that extend continuously to the central core. The fish plates, tapering in thickness from 0.6-0.3-inch, serve to assist the fastening of the exterior upper shells to the central core. One-half the plate width is shaped to conform to the inboard end of the shell, while the other half is flat to permit a flush-fit against the adjoining spandrel beams in the core.

The hyperbolic paraboloid roof is made up of four sections, each with an eight-foot horizontal projected area, two-foot vertical sides, and a four-inch flange for fastening the sections together to form the parabolic unit.

The miscellaneous plates are used for reinforcing the floor, roof, and spandrel beams that are made of laminated wood. Plate thickness is 0.6-inch, and the plates are bonded to the beams on those sides to which the floor or roof panels are attached.

The three by three-inch angles are utilized in connecting the floor panels to the exterior shells, and the roof sections to the central core. They also serve as

vertical stiffeners for the lower outer shells where the box section is deepest; one leg of the angle is bonded to the sidewall of the shell, and the other leg acts as a fin.

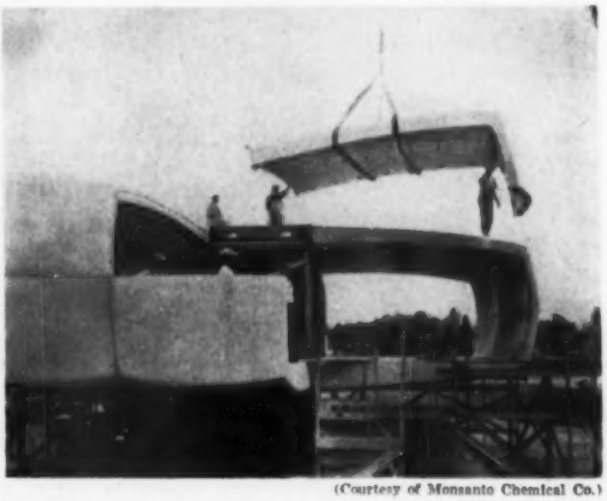
Performance Requirements

Upon analysis of the engineering design of the House, it was realized that the major criterion was one of rigidity rather than strength, and that maximum stiffness could be obtained by an appropriate design of bent-box section and by selection of suitable material type and thickness.

A fiberglass-reinforced polyester plastic was considered the preferred choice of construction material, since it provided strengths comparable to those of structural steel and aluminum, a relatively easy method of fabrication adaptable to the complex curves of the House, and the ability to be molded in large one-piece sections at a reasonable cost for an experimental structure of this type. Stress levels under load and minimum strength requirements were calculated, leading to a testing program involving full-scale test bents. This program was undertaken to determine the actual stresses and deflections that might be encountered under severe loading conditions in the field. The results that were obtained more than substantiated the adequacy of design, the safety factor being larger than had been anticipated.

Based on these test results the following performance specifications for mechanical properties were required on test panels taken from the production run of the molded structural parts:

	Minimum average of five tests
Modulus, 10^6 psi.:	
Compression	1.50
Flexural	2.25
Tensile	2.50
Ultimate stress, psi.:	
Compression	20,000
Flexural	35,000
Tensile	30,000



(Courtesy of Monsanto Chemical Co.)

Fig. 2. An upper wing compartment (outershell) being lowered into position during assembly.

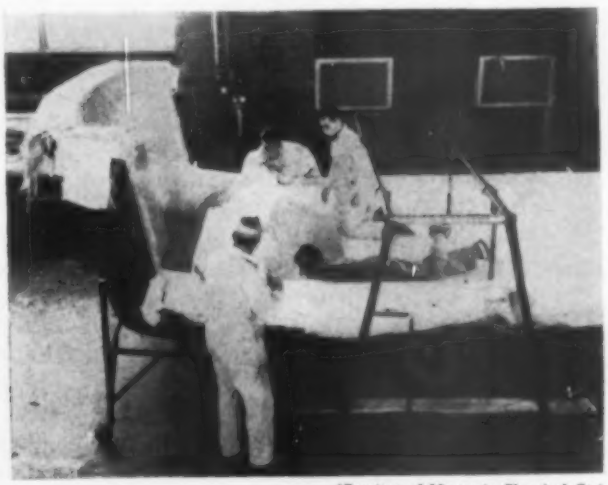
Molds

Plastic molds were used in making all parts, except the flat structures and the angles. Molds made from fiberglass-reinforced plastic materials were adjudged as being the most feasible because of the complex shapes being molded, the necessity for dimensional stability at part-curing temperatures, the high strength requirements, low cost in comparison with other mold-making materials, and short lead time. Since the vacuum-bag molding method was adopted for all parts, except the angles, a single male or female mold was required for each structure.

High heat-distortion resistant epoxy resin reinforced with woven fiberglass roving, together with a phenolic-impregnated kraft paper honeycomb core, 1½-inches thick, were the materials used in making the molds for the exterior shells, ceiling shells, stub walls, and fish plates. These molds were derived from wood patterns, and the latter three classes of mold were of the male type that required a double transfer from wood to plastic female to the final plastic male mold. Except for the fish plate mold, all molds were mounted on a metal pipe framework to prevent racking while casters provided the necessary mobility.

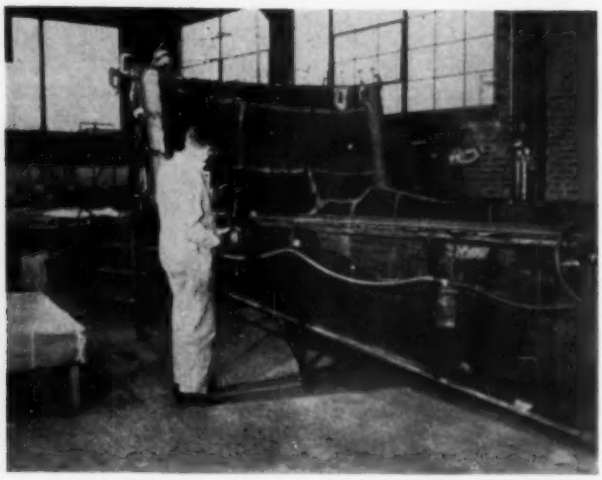
Each mold had six-inch wide flanges that provided a clamping area when laying-up vertical section laminates. Vacuum ports spaced approximately four-feet apart and interconnected by means of braided rubber hose were attached to the flanges. Allowance was made for any excess resin being sucked into the vacuum lines by installing glass jars as resin traps directly under the ports.

The mold used in fabricating the roof quadrants was a female made directly over a wood male pattern. The resin employed here was a high-strength, hand lay-up polyester cured with a low-temperature catalyst. Reinforcement and rigidity were provided by woven roving and four-inch thick phenolic-kraft honeycomb. The mounting frame consisted of ¾-inch thick plywood strips cut to the outside mold contour and criss-crossed at two-foot intervals to form an egg-crate arrangement. The frame was attached to the mold by means of 1½-ounce fiberglass mat strips and polyester resin. One leg of each strip was laminated



(Courtesy of Monsanto Chemical Co.)

Fig. 3. Glass fabric being positioned in the exterior shell mold. Underlying ply has been coated with polyester resin.



(Courtesy of Monsanto Chemical Co.)

Fig. 4. Sealing ring being clamped to the shell mold to ensure correct molding pressure during cure of exterior shell.

to the wood, and the other leg laminated to the outer mold surface.

The plastic angles were made in 17-foot sections in a mold made up of two steel angles measuring four by four inches, one set upon the other. Stops, 5/16-inch thick, were welded to the lower steel angle to ensure the correct part thickness and prevent excessive resin squeeze-out. The upper angle was attached to an electrically-driven hoist by a steel chain. The mold was steam heated, with the steam line running along the inside radius of the lower steel angle, and metal conductivity was relied on to cure the extremities of the plastic angles. The matched angle mold was mounted on a two by four-inch wood frame. Trim lines were scribed on the molds to eliminate the necessity for marking the lines on each part.

Construction Materials

A fire-resistant polyester resin having chemical- and water-resistant characteristics, together with good resistance to heat distortion, was chosen for all interior laminated parts, while a light-stable polyester was used on all exterior components. The latter resin was formulated with 2% light gray pigment based on the resin weight. After careful study and trials, the reinforcement found to be most desirable for this fabrication was a balanced woven roving fabric with its advantages of good drape, short wet-out, and high bulk resulting in relatively few plies and fast laminate build-up. Silane finish was specified for obtaining maximum dry and wet strength properties.

All the sandwich constructions (namely, floor sections, ceilings, tension panels, and compression panels) utilized a phenolic-impregnated paper honeycomb structure (weighing 3¾ pounds/cubic foot) as a core sandwiched on both sides by laminates of differing thickness. The use of rigid plastic foam in the structural components was predominantly for insulation purposes, although it did serve to impart some rigidity to the shells. The foam employed was essentially a polyurethane-diisocyanate type of seven pounds/cubic foot density, and was applied to the shell interiors by using a hot-spray technique. Also, a light-density polystyrene foam (1¼ pounds/cubic foot), precut to one-inch slabs, was utilized on the insides of the roof quadrants. Epoxy resins cured with low-temperature hardeners and 181-glass cloth formed the sub-assembly fastening materials in conjunction with ¼-inch bolts for installation of floor panels, stub walls, and ceilings in the exterior shell sections.

The sealing of cut-out sections in tension, compression, and floor panels where large areas of honeycomb was exposed was accomplished by an edge-fill mix consisting of epoxy resin filled with chopped fiberglass and asbestos powder plus a mineral filler to provide non-sagging qualities before cure.

Fabrication of Structural Parts

The fabrication of the structural parts involved the usage of about 20,000 lbs. of polyester resin, 60% of which was the fire-resistant type. Consumption of woven roving amounted to some 25,000 pounds and honeycomb usage was 2,000 square feet, about 66% being the four-inch thick material. To insulate and stiffen the exteriour shells, 4,000 pounds of urethane foam were required while 360 square feet of polystyrene foam were employed to insulate the roof section.

Exterior Shells

Mold preparation entailed applying a wax coat to the cleaned surface, then buffing the wax to a high gloss, after which two coats of polyvinyl alcohol parting agent were sprayed on. More wax was then applied over the air-dried PVA film to prevent the initial layer of the final sprayed resin from running down steep sections of the mold.

Since the specified resin content of the laminates was 35-45% by weight, it was preferable to work to the high side of the tolerance in order to mitigate the possibility of dryness or delamination. Since 10 plies of woven roving were used for the 0.3-inch thick section, the resin mix was divided into 10 equal batches plus a slightly heavier extra batch for the first coat. It was found that a slight excess of resin against the mold surface reduced voids at the interstices of the fabric, and that a 6% content of aerated silica filler in this first coat helped to increase the viscosity of the resin

(Courtesy of Monsanto Chemical Co.)

Fig. 5. Urethane foaming mixture being applied to interior of exterior shell held in special reinforced plastic cradle to prevent shell distortion during foaming.

such that it would hold to the vertical sides of the mold while still being of sprayable consistency.

The woven roving, 50-inches in width, then was placed cross-wise in the mold with the fabric ends clamped to the flanges of the mold to hold the glass in place while the next resin spray was applied. It had been found that laying the reinforcement across the width of the mold, rather than lengthwise, resulted in much faster lay-up. There were eight patterns for each ply and the butt joints between patterns were staggered five-inches from one ply to the next so that no two joints were vertically aligned. A mobile overhead rig was mounted within the mold so as to allow two operators to position the fabric from the inside (see Figure 3). Air pockets were removed by using hand rollers that also aided in wetting the fabric.

The next batch of resin was sprayed evenly over the woven roving and the second ply laid up and rolled out as before. This was continued until 10 plies had been placed in the mold, and a final coat of resin deposited over the last ply. Next, the excess glass around the flanges was trimmed off so as to prevent interference with the clamping ring. A layer of PVA sheeting was placed over the lay-up, and one-foot wide burlap strips were set criss-cross over the PVA. These served as air bleeders and were run out to the vacuum ports on the mold flanges. A rubber blanket tailored to the inside dimensions of the mold then was unrolled into position over the build-up and a peripheral clamping ring installed on the mold flange (see Figure 4). A vacuum of 26-28 inches was applied next to the laminate, after which the mold was wheeled into a large oven heated by steam radiators with a blower to distribute the heat evenly. The oven temperature was maintained at 180-200° F.

The curing system employed in the resin mix was an MEK peroxide low-temperature catalyst in conjunction with benzoyl peroxide and a cobalt naphthenate activator. The low-temperature catalyst was used to initiate polymerization of the resin and activate the benzoyl peroxide catalyst which completed the cure. The overall curing time was 2½ hours, while the total lay-up time from mold preparation to application of the vacuum was about eight hours. The cured part was removed from the mold by an overhead hoist attached to wooden cross-struts clamped across the flanges to prevent the shell sides from buckling inwards under load. The molded shell then was set in a mobile cradle made up of two pieces of plywood cut to the outside dimensions of the shell and mounted on a skid.

The next operation required for the 16 exterior shells was the installation of rigid urethane foam insulation on the inner walls (see Figure 5). For this operation, the shells had to be transferred to a special cradle in which the shell shape was maintained accurately, thus precluding any distortion during the foaming process. This cradle consisted of reinforced-plastic supporting straps, one foot wide and spaced two feet apart, attached to a tubular metal frame approximating the outside contour of the shell. Mobile spraying equipment mounted on tracks for lateral movement in two directions was used to foam the material in place to a depth of 3½-inches.

The cured foam surface was levelled off afterwards with a portable rotary planer to provide a uniform surface for an interior laminated skin that was to be bonded to the foam. This skin was designed to further improve rigidity and lessen any possibility of racking. It was found that a much stronger bond was obtained by removing the outer "crust" of the foam, thus exposing the cells to penetration by the laminating resin. The interior skins for the eight lower shells extended six feet outwards from the inboard part of the shell and were 0.15-inch thick (five-ply woven roving). The skin at its periphery was joined to the main shell by removing the foam in these areas and sanding the surface of the shell to provide adequate adhesion. The skins were applied directly over the foam by the hand lay-up, contact pressure, room-temperature cure method. The eight upper shells had interior skins of the same thickness, but were extended approximately 15 feet outwards.

Sandwich panels

The eight floor panels for the exterior shells and the two floor panels for the core were all molded on a 17 x 18½-foot table made up of aluminum sheeting bolted to an angle-iron frame that was mounted on casters for transfer to and from the oven. The aluminum sheeting was held to a surface flatness of 0.1-inch maximum, while all butt joints between the sheets and all bolt heads on the surface were sealed with a flexabilized epoxy resin to provide a tight seal capable of expanding and contracting with the metal while the high-temperature vacuum cure and cool-down were effected.

Trim lines for all the floor panels were scribed on the table surface and, thus, embossed in the moldings to avoid marking the individual panels. The release system was wax and sprayed-on PVA, and the build-up of 10 plies of woven roving was similar to that of the shell. After the tenth ply was positioned, a viscous resin coat was applied. A fairly high resin viscosity was required to prevent resin run-off before installing the honeycomb, since it was found that a large quantity of resin was necessary to obtain a good fillet into the honeycomb core. By using an amount of viscous resin mix equal to four times the weight of the adjoining glass ply,

(Courtesy of Monsanto Chemical Co.)

Fig. 6. Rolling in a ply of glass fabric during lay-up of a ceiling section.

a fillet ⅛-inch deep was obtained upon curing.

The honeycomb edges to be bonded were roller-coated with resin to assist wetting and the four-inch thick core then was placed on the thick resin layer. The honeycomb had been precut and fitted on the table prior to the molding operation, and a 45° bevel was cut on all peripheral honeycomb edges. Precise location of the honeycomb was obtained by indexing from the outside edge of the table using plywood fences, clamped to prevent misalignment. For the lay-up proper, the plywood was wrapped in PVA film so that the patterns could be re-used. After the core had been located, the adjoining ply of glass had to be heavily coated with resin similarly, but with a still higher resin viscosity than was used on the lower adjoining ply, since run-off was more of a problem on the top side of the honeycomb. Whereas 6% thixotropic agent was used with the lower ply, 8% was required with the upper. This ply was resin-sprayed on a separate table, and then transferred to the lay-up where it was inverted rapidly and placed on the honeycomb.

The construction proceeded with the alternate resin layer-and-glass build-up to a thickness of four glass plies This yielded a molded skin thickness of 0.1-inch, the over-all floor panel thickness being 4.4 inches. The flange of the exterior panels varied in width from three inches at the outboard end to 12 inches at the inboard end where the fastening of the panel to the foundation was to occur. This flange was made up of the 10 upper skin plies plus the four lower skin plies that extended beyond the honeycomb, thus sealing the latter in on all sides. A 40-mil aluminum caul sheet was installed over the flange area lay-up to provide an even surface on the underside of the flange, thus eliminating pre-assembly grinding to uniform thickness. PVA sheeting, burlap strips and an outer PVA vacuum blanket were applied to the uncured structure, and the blanket sealed to the table with a zinc chromate-type sealing compound. The table then was transferred to the oven where the panel underwent a three-hour cure at 150° F. and 20 inches of vacuum.

The tension and compression panels, being eight feet square, were molded two at a time employing similar lay-up and cure techniques on the same table as that used in making the floor panels. The miscellaneous plates also were molded on this table, but the build-up consisted of 20 plies of woven roving to obtain a 0.6-inch thick section. The individual plates were cut from the 16 x 7-foot molded panel.

Other Components

Constructing the ceiling sections (see Figure 6) entailed using the same procedure for the three-inch skin as for the exterior shells. A 6 x 7-foot, three-inch thick honeycomb structure, however, was installed at the inboard end, thus providing stiffness to the part and again necessitating heavy resin layers adjacent to the honeycomb faces. The inboard area lay-up continued in a manner identical to that used in making the 0.1-inch thick skin of the floor panels. The vacuum blanket was rubber tailored to the inside mold dimensions and sealed against the mold flange by means of a foam rubber gasket mounted on an angle-iron frame, while C-clamps spaced one foot apart provided the sealing pressure.

The stub walls and hyperboloid roof panels were fabricated using the aforementioned techniques of alternate resin sprays and glass plies; hand-rolling to remove air pockets and aid wetting; staggered butt joints; PVA-wax parting systems; burlap air bleeder strips; and an outer vacuum blanket (rubber in the case of the stub wall, and PVA film for the roof panels). Cure took place at 150° F. using the combination of low- and high-temperature catalysts, while curing times were determined by temperature readings obtained from a potentiometer using wires located at various positions in the laminate. A time interval ending approximately one-half hour after exotherm of the slowest-curing area was considered practical for complete cure. Temperature checks were taken on the first few moldings of each type of part.

With the stub wall, a return flange four-inches wide running parallel to the main panel called for the use of a bevelled insert in the mold to facilitate removal of the cured part. One side of the insert formed the face against which the return was molded. The fish plates were laid up on a male mold with 20 glass plies for the 0.6-inch section, tapering to 10 plies for the 0.3-inch section. An aluminum caul plate positioned on top of the lay-up gave a smooth even exterior surface to the molded pieces. Cure was effected under vacuum using a PVA sealing blanket.

Fabricating the angles required a slightly different technique in that the lay-up was not done on the mold. The 10 glass plies were built up and impregnated, a ply at a time, using a perforated can for sprinkling the resin evenly over the eight-inch wide fabric. The lay-up was made on an oversize piece of PVA sheeting; the excess being folded over the top of the completed lay-up to serve as a parting film and to retain the subsequently squeezed-out resin, thereby avoiding a major clean-up operation. Next, the whole lay-up was transferred to the mold and positioned evenly over each leg of the angle. The top female steel angle was lowered into place, and toggle clamps provided the pressure to close the mold to stops. Steam was applied for 1½ hours after which a one-hour cooling period was allowed before removal of the cured part.

Secondary Operations

The nature of the molding techniques necessitated trimming-off excess material on all parts to obtain the required dimensions. Trimming was accomplished with a portable electric saw using an abrasive cutting wheel that cut faster and was more economical than a metal saw blade. Accuracy and straightness of cut were difficult to maintain on some parts, especially the long horizontal trim lines of the shells where the weight of the saw, together with dust accumulation, proved burdensome. In these instances, it was found feasible to trim approximately 1/10-inch outside the trim line, then grind to size with a flexible disc sander. Angles were trimmed with a circular table saw using a carbide-tipped blade. All structural sections were required to be true and within dimensional tolerances of ± 1/16-inch. Laminate thickness tolerance was held to minus 0.015- and plus 3/32-inch for 0.15-inch nominal thickness, while a tolerance of minus 0.030- and plus

1/8-inch was specified for moldings of 0.30-inch thickness.

Accurate location of 5/16-inch diameter bolt holes was obtained by employing drill jigs on outer floor panels, angles, stub walls, ceilings, and exterior shells required drilling prior to their assembly into wing components. The preferred choice of drill bits were those with carbide tips.

Hand-holes in the ceiling and stub wall sections (shown in Figure 2) were machined by drilling a pilot hole and routing with a five-inch hole saw. These hand holes served the purpose of providing accessibilty during installation of nuts and bolts in the preliminary assembly operations, and also during erection of the wings at the exhibition site. Having performed these functions, the holes subsequently were used as air-conditioning vents and outlets for the sprinkler system.

All areas of connection and attachment requiring a bolt-and-bond fastening operation first had to be sanded if maximum joint strength was to be realized. Bonding surfaces of angles, panels, plates, shells, etc. were roughened with a disc grinder to remove the glossy surface layer of the laminates, while the plane faces of the floor panels were scuffed uniformly with a floor sander using No. 40 sandpaper (this being necessary for the later application of plastic floor covering).

The roof panel insulation in the form of tailored one-inch thick slabs was installed using an epoxy resin adhesive and a vacuum bag that was sealed off along the sides of the panels. Vacuum pressure maintained conformance of the rigid foam to the paraboloidal shape during the cure period.

Final Assembly

Assembly operations of the wing components were performed at Winner prior to shipment of the structures for final erection. First, the angles were installed horizontally in the lower shells, this being done by fastening with ¼-inch bolts in conjunction with a room-temperature curing epoxy adhesive and 181 glass cloth; the latter was used to distribute the adhesive in a uniform layer, and to implement bonded joint strength. Working life of the adhesive was adjusted so as to allow time for tightening the bolts before the resin cure began. A floor panel then was placed in the shell with the lateral flanges mounted on the horizontal legs of the angle. Flathead bolts and adhesive were used to complete the junction. The stub wall sections were inserted at the outboard ends of the shell, being fastened to one edge of the floor panel and the shell sides by means of flange connections.

The installation of the ceiling in the upper shell was performed similarly, again using a bolt-and-bond fastening mechanism. A sprinkler piping system using one-inch pipe had been affixed previously to the upper side of the ceiling section by means of epoxy-glass cloth straps that tied the pipe onto the laminate. The narrow space between the assembled ceiling and shell made it advisable to install permanently this part of the sprinkler system prior to the assembly. In addition, the high strength tie-in precluded any independent movement of the pipe during handling and shipping.

A crane was required to transport the wing components and large sandwich panels to railroad box cars where four bents were loaded to a 40½-foot car, floor panels being placed on end between the bents. All sections were shored securely against the car sides with wooden beams in case of excessive humping during transit, a frequently-encountered phenomenon with freight trains.

Final shipment was made exactly 90 days after the first production molding operation began, and erection of the structural components was completed some three weeks after the last delivery.

—The End

Neck-In Problem in Polyethylene Extrusion Coating and Film Casting
(Cont'd. from page 919)

0.929, melt index 5.0), 207 (density 0.924, melt index 8.0), and 200 (density 0.916, melt index 3.0) are marked in the chart. Using the above equation the neck-in values for these three resins in this particular situation can be figured at 3.1, 2.8, and 0.6 inches, respectively, that correspond with the values established by means of the chart.

Applications

Machine conditions and resin properties that reduce neck-in cannot always be fully utilized because they may adversely affect other essential coating or casting properties or the economy of the coating or casting process. A few examples follow.

Comparatively low adapter and die temperatures have been shown to have a reducing influence on neck-in. However, good adhesion to the substrate depends primarily on high stock temperatures. For Petrothene resins, a melt temperature of approximately 610° F. generally is recommended.

Low coater speeds decrease neck-in when high-melt index resins are used, but a decreasing draw-down rate increases the cost of coating and film casting.

Neck-in can be considerably reduced by using a polyethylene of lower density, as indicated by the above equation and the diagram of Figure 2. On the other hand, higher density improves moisture and moisture-vapor resistance, grease proofness, impermeability to oxygen and essential oils, chemical resistance, stiffness, and scuff resistance. These all are properties essential in film and, especially, substrate coating.

A combination of low density and low melt index will result in minimum neck-in, as explained. Unfortunately, however, there is an optimum combination below which voids in the hot web will occur at low coating or casting speeds. For example, Petrothene 200 in the processing situation described in Figure 2 gives a neck-in of only about 0.6 inch. This is a very small neck-in, but voids may occur in the hot web at a draw-down speed of about 160 feet per minute. Therefore, in this situation, such resins as Petrothene 210 or 205 may be preferable.

—The End

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By: L. J. ZUKOR, *Engineering Editor*

Blocking characteristics . . .

. . . of polyethylene film, when uncontrolled, have occasioned loud objections from converters in the packaging field. Severe blocking will cause film to adhere so completely that, once wound to form a roll, it becomes almost impossible to unwind the roll without destroying the film. When blocking is moderate, it may be tolerated in wrap material. If this same material, however, should inadvertently be sold to bag manufacturers, the bag will be objectionable since it cannot be opened easily or

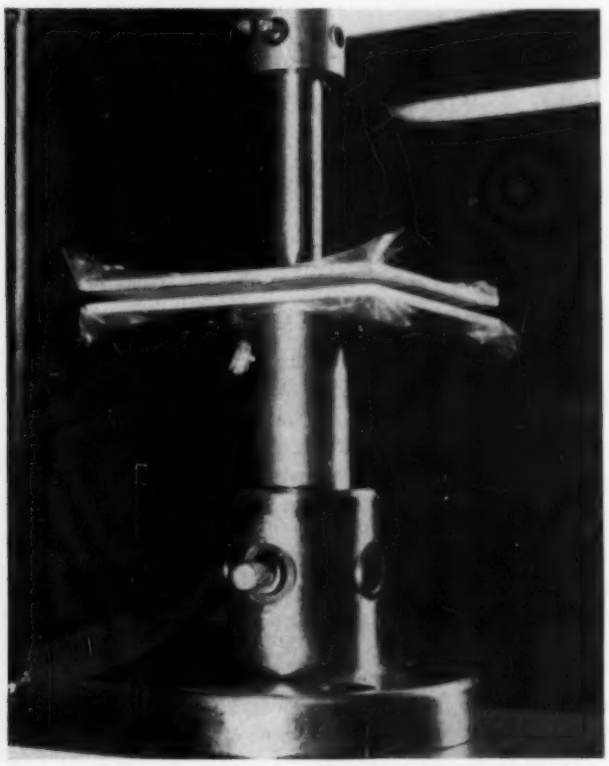


Photo courtesy of U. S. Industrial Chemicals Co.

used on automatic filling machines. Many material producers, being aware of this situation, include additives which are known as slip and anti-block agents. A good slip or anti-block agent must "bloom" or exude to the surface within a short time after processing, thus forming a molecular layer on the film which will promote slip.

A new method is described by U. S. Industrial Chemical Co., wherein a manufacturer can determine whether or not his film will slip or block. This test is a comparative test that can be measured against standards previously established by the manufacturer. Called the perpendicular-force test, it measures the force required to separate touching layers of polyethylene film in a perpendicular direction. The accompanying photo shows the two film layers just beginning to separate under a force which pulls the two metal discs with the wrapped-around film away from each other.

•

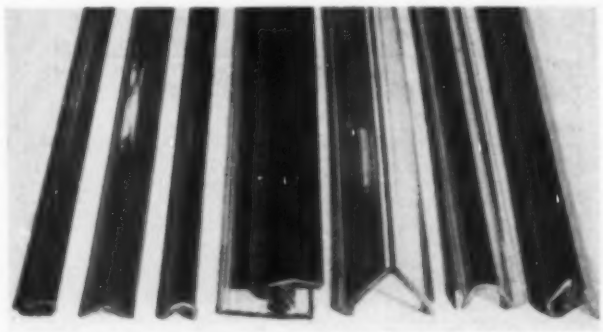
Extruded shapes . . .

. . . with metal foil inclusions are a recent development in plastics. These are manufactured on standard extrusion machinery in much the same fashion as insulated wire. In practice, one outstanding difference is the inclusion of a metal forming die in the line just prior to the extrusion die. This die can be as simple as a pull-through type that will form an angle or "U" shape from a flat ribbon; or as complex as a roll form die that would emboss or otherwise shape the continuous strip into complicated geometric patterns. It is important that the metal forming die, as well as the extruding die, have highly polished surfaces so that the finished extrusion will not be marred by longitudinal striae.

Among the problems that beset an operator in the manufacture of embedded plastic extrusions are the centering of the metallic strip in the plastic, and the proper adhesion of plastic material to the metal. The former is dependent upon a well-made and well-adjusted extrusion die, and the speed of draw-off of the extrusion from the die through the cooling water bath. Adhesion forces in the laminated material are dependent on the following: the blocking characteristics of the extrudate; the proper cooling of the extrusion so that differential contraction of the materials is limited; and clean surfaces of the metallic ribbon.

Another method that is thought to increase adhesion of plastic to aluminum is to etch the aluminum finely and imperceptably in an anodizing solution or a solution containing boric acid. This method increases the "tooth" of the metal, thereby increasing its mechanical hold on

Battery of extrusion machines at Anchor Plastics Co.



Photos Courtesy of Anchor Plastics Co.

Typical sections of extrusions with metal foil inclusions.

the plastic. The Aluminum Corporation of America has a process called "Alumilite" which is similar to anodizing and also imparts color to the metal surface. It is possible by this method to obtain many and varied decorative patterns. Another way to obtain other than the standard aluminum or chrome-like colors is to embed the metal in transparent colored plastics.

The plastic materials presently used in this process are cellulose acetate, cellulose acetate butyrate, the acrylics, and styrenes.

Anchor Plastics Company, of Long Island City, New York, is one of the successful manufacturers extruding sections containing metal foil. That firm's work shows a complete and comprehensive knowledge of this specialty. Through intensive research Anchor has developed techniques for producing, among other things, a bezel for a television tube for the Philco Corporation. This is an extrusion with the metal foil insert formed into a complex ring.

The editors are hoping to meet as many of our readers as possible at the Eighth National Plastics Exposition in Chicago on November 17-21. The writer looks forward to being with you and offering his help on any questions with regard to machinery and/or plastics processing.

Injection Machine . . .

. . . shop operators often experience difficulties that tend to increase scrap formation. Many of these difficulties are normally due to improper adjustment of the molding machine and/or the use of material of unknown or improper melt index. To prevent the latter, material manufacturers are presently labeling the bags of plastic with the physical characteristics required by the processor. Many material manufacturers do not limit their responsibility to the naming of the characteristics of each batch, but also include laboratory studies and publish the findings of these studies to the industry. In many cases a material manufacturer will, at his own expense, set up with the processor's dies and supply the injection molder with empirical data peculiar to the individual set up. All manufacturers, from time to time, publish helpful hints and release training material to the industry as a necessary service. A recent publication has been released by the Foster Grant Co. (see our New Literature section) for injection molders.

Management should find material of this type extremely helpful as a training aid for new employees, and as a means to re-orient operators when high reject rates point to laxity in operations.

Photos Courtesy of Foster Grant Co.

Determining Molecular Weights of Thermoplastic Materials

(*Cont'd. from page 912*)

for high-pressure polyethylene also would show a linear relationship between molecular weight and deformation power, but the slope of the curve would be greater.

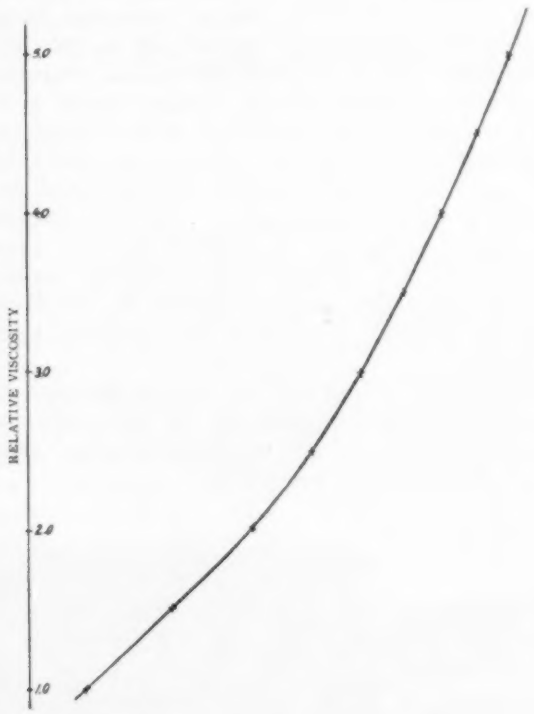


Fig. 5. Relation Between Relative Viscosity and Deformation Power for High-Density Polyethylene Measured in the Plastograph at 160° C. and 28 Rpm.

Nitrocellulose

Six 50-gram samples nitrocellulose-plasticizer mixture (40/60 ratio) with different K-values, but with constant nitrogen content, were tested in the Plastograph's jacketed-roller measuring head at 56 rpm. and 50° C. The nitrocellulose was dried at 70° C. for one hour, and 30 grams of plasticizer were added to 20 grams of dried nitrocellulose in the measuring head by burette.

The results of these tests are shown in Table 4 and Figure 6. Dioctyl phthalate was used to illustrate the need for a plasticizer that forms a gel—a requisite for measurement of molecular weight by the C. W. Brabender method. Dioctyl phthalate, however, is not a proper vehicle for testing nitrocellulose by this method.

Conclusions

The C. W. Brabender Plastograph provides a simple, rapid, and accurate replacement for the more complex and time-consuming method of determining viscosities from dilute solutions. The method provides data in direct terms (meter-kilograms per second of deformation) that are more meaningful and useful to the process engineer and production man.

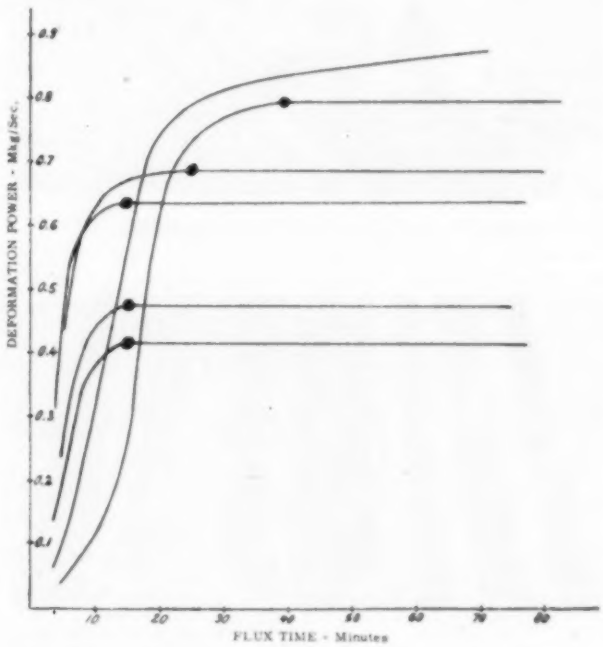


Fig. 6. Relation Between Deformation Power and K-Value for 40:60 Nitrocellulose:DBP Mixtures Measured in the Plastograph at 50° C. and 56 Rpm.

Acknowledgment

This paper is based on original research performed in the Research and Development Laboratories of Brabender, O. H., Duisburg, West Germany.

—THE END

Let's Tell The People

(*Cont'd. from page 917*)

Then they repackage these compounds for their kits and simply label the bottles "Plastic" "Activator," and "Promotor." One of these days a curious hobbyist may find out disastrously that the "activator" and "promotor" will explode when mixed together!

Industry-wide informative labeling contest, like the ones sponsored by SPI, are certainly a step in the right direction. Perhaps, what is really needed, however, is a federal law requiring the *full* labeling of all plastic products.

There is also some "mumbo-jumbo" in the advertising and selling of plastics. Some of the 2000 fabricators and countless retailers in this business do not realize that the best form of public relations is the truth. Instead, they rely heavily on merchandising gimmicks, half-truths, and uninformed salesmen.

We have noticed that although people are primarily interested in acquiring practical knowledge about plastics, they are concerned also with the academic aspects.

Each of us in the plastics field has plenty to tell the people—not only to help them shop more wisely and make better use of the plastic products that they already have but also to give them a better appreciation of these materials and of the scientists and engineers who make them possible. It's high time that we do it.

Eighth National Plastics Exposition

The Eighth National Plastics Exposition, sponsored by the Society of the Plastics Industry, Inc., will be held in the International Amphitheatre in Chicago, Ill., on November 17-21. Returning to the Chicago area after a lapse of eight years, the biennial show is firmly established as a functional institution in the plastics field, and the coming Exposition is expected to attract a record-breaking attendance of more than 20,000 representatives from all phases of industry, government, and education dealing with plastics.

The Exposition, which is not open to the public, will include more than 205 companies, both foreign and domestic, whose displays will cover the entire gamut of materials, processes, equipment, products, and services used by the plastics industry. The theme of the show will be "Plastics for Profits," and the theme center will be an historical exhibit of important representative "firsts" marking the progress of the industry in the past 90 years (since 1868). The exhibit floor space will cover more than 100,000 square feet, the largest total display space of any previous National Plastics Exposition. The show will be open from 1-6 p.m., except for Thursday, Nov. 20, when the show hours will be 1-9 p.m.

PLASTICS TECHNOLOGY will be occupying Exhibit Booth #571 at the show, and will be staffed by both editorial and business department personnel. We cordially invite you to stop in to meet and visit with us, and describe any suggestions that would make the magazine of greater interest and value to you in your work.

Eighth National Exposition of Plastics Has Practical Answers To Quality, Cost-Saving Problems

JOHN J. BACHNER, *Pres.*,
Chicago Molded Products Corp.
Chairman, Eighth National Plastics Exposition

The Eighth National Plastics Exposition in Chicago's Amphitheater, on November 17-21 will be a magnetic center of attraction for the top management, design, engineering, production and marketing executives of every manufacturing industry seeking effective answers to the allied problems of product quality, costs, consumer appeal and competition.

Perhaps never before in modern business history have the materials and methods of a single industry—plastic—offered so many solutions to so many current and future management, manufacturing and marketing problems.

Because the Chicago Exposition, sponsored by SPI, will demonstrate that plastics has a host of practical answers to lower end costs; better, more attractive products; more economical raw materials; and more efficient, cost-saving machinery and methods for utilizing them, its theme, appropriately, will be "Plastics for Profits." The cost consciousness that currently dominates management thinking plus the mounting competitive marketing pressures that urgently require constant improvement of design and product will be most important factors contributing to a record top management attendance at the Chicago Exposition.

It has ben effectively and repeatedly demonstrated in recent years, that plastics, properly utilized and efficiently fabricated and processed, is doing or can do more jobs as well, or better, than competitive materials and methods. Most important, plastics is performing these jobs at the same or lower costs, while achieving comparable or greatly improved quality and performance not only in industrial, consumer and commercial products, but also in the most advanced military devices

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and equipment. While some initial plastics costs may appear high, they are more than off-set all along the line by cumulative savings in production, assembly, finishing, packing and shipping costs.

In an era marked by narrowing profit margins, every echelon of management is vigorously seeking, testing and employing materials and methods capable of keeping production costs within profitable bounds without sacrificing quality and performance. Since this search for cost-saving materials and methods is directed at the executive level, the National Plastics Exposition will naturally merit and receive the personal attendance and attention of top management, as well as executives and department heads responsible for design, engineering, processing and sales.

Top management attendance at the last SPI National Plastics Exposition in 1956, which was triple that in 1954, accounted for more than one-third of total attendance. This, in itself, indicates that owners and managers of plastics-users in all manufacturing industries are fully aware of the necessity for keeping abreast of swift-moving research and processing developments in plastics.

More than 200 comprehensive exhibits at the Chicago Exposition will demonstrate that all segments of the plastics industry in the past two years have accelerated their research and development progress, continuously improved their production machinery and methods; have extended the advantages and benefits of plastics to more users; and have created broader new markets for plastics users.

The Chicago Exposition will unquestionably demonstrate that the plastics industry is better equipped than ever before to serve its present industrial and consumer outlets, and has the mature scientific and technical capabilities to both serve its growing roster of new industrial users and expand its versatile services to established customers.

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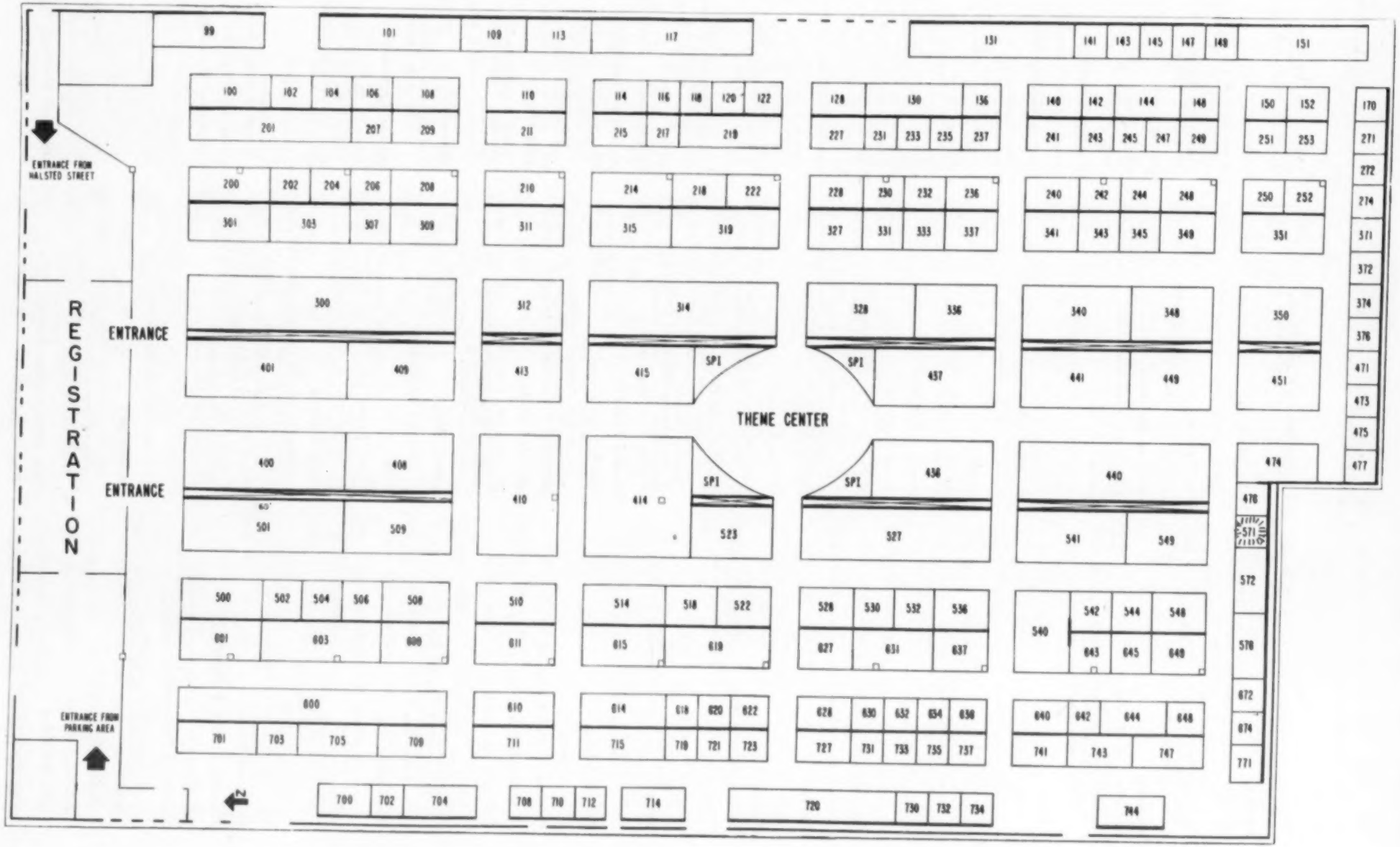
Floor Plan of Exhibit Area



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Celanese Corp. of America 440, 448
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E. I. du Pont de Nemours & Co., Inc., Film Dept. 522
Monsanto Chemical Co. 300, 308
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Bee Chemical Co., Logo Division 240

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Bakelite Co., Div. of Union Carbide Corp. . 401
Cadillac Plastic & Chemical Co. 711
E. I. du Pont de Nemours & Co., Inc., Polychemicals Dept. 414, 515

Glass Mats, Fabrics, Rovings, Yarns

Ferro Corp., Color Div. 627
L.O.F. Glass Fibers Co. 530
Owens-Corning Fiberglas Corp. 315
Pittsburgh Plate Glass Co. 120

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Acme Machinery & Mfg. Co., Inc. 236
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Cumberland Engineering Co., Inc. 340
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Glenn Electric Heater Corp. 640
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Ball & Jewell, Inc. 214
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The Rainville Company, Inc. 603-7
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The Hydraulic Press Mfg. Co., Div. of Koehring Co. 117-25
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Kingsley Stamping Machine Co. 712
Markem Machine Co. 345
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Olsenmark Corp. 230

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Apex Machine Co. 149
Olsenmark Corp. 230

Masks, Spray-Painting

Conforming Matrix Corp. 614-6

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Catalin Corp. of America 449
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Omni Products Corp. 301
Plastics & Coal Chemicals Div., Allied Chemical & Dye Corp. 400
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Mills

Erie Engine & Mfg. Co. 331

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Minnesota Mining & Mfg. Co. 601
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Polygon Plastic Co., Affiliate of Plas-Steel Products, Inc. 374
Vogt Manufacturing Corp. 734

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Danielson Mfg. Co., and Molding Systems Division 709
Joseph Davis Plastics Co. 307
General American Transportation Corp. 518
Plastics Engineering Co. 328
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Whitso, Inc. 102

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Capac Industries, Inc. 719
Durable Formed Products, Inc. 233
The Fiberite Corp. 504
Filon Plastics Corp. 150
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Danielson Mfg. Company, and Molding Systems Division 709
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Catalin Corp. of America 449
E. I. du Pont de Nemours & Co., Inc., Polychemicals Dept. 414, 515
Plastics & Coal Chemicals Div., Allied Chemical & Dye Corp. 400
Spencer Chemical Co. 219-23

Polyesters

Archer-Daniels-Midland Co. 572, 574
Atlas Powder Co. 542
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B. Blacher 618

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National Lead Co. 140
Nuodex Products Co. 730
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The Dow Chemical Co. 437
Firestone Plastics Co. 413
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Marbon Chemical Div., Borg-Warner Corp. 631-3
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Ralph B. Symons Associates, Inc. 720-8
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Cary Chemical Co., Inc. 703
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The Dow Chemical Co. 437
Firestone Plastics Co. 413
The General Tire & Rubber Co., Chemical Div. 622
B. F. Goodrich Chemical Co. 509
Interchemical Corp. 200
Monsanto Chemical Co. 300, 308
Montecatini Soc. Gen. (c/o Chemore Corp.) 523
Naugatuck Chemical Div., U. S. Rubber Co. 415
Omni Products Corp. 301
Reichhold Chemicals, Inc. 500

Vinylidenes

The Dow Chemical Co. 437

Web Processing Equipment

John Waldron Corp. 747-9

News of the Societies

SPI Conference Program

The conference end of SPI's Eighth National Plastics Exposition will be held at the Hotel Morrison in Chicago, opening Monday morning, November 17, with a press breakfast and preview of the Exposition. This Conference will include both talks and panel discussions by government officials, management, engineers, production experts, and market analysts representing plastics-producing and plastics-using industries.

Three concurrent sessions will be held 9:30 A.M. to noon on Tuesday and Wednesday, and a single morning session is scheduled for Thursday. Sessions, moderators, topics, and speakers are reported as follows:

Tuesday morning, November 18

Sheet Forming session, moderated by C. C. Whitacre, Midwest Plastic Products Co.:

"The Use of Formed Plastic Sheets in Packaging and Merchandising," Donald Leeker, Sears, Roebuck & Co.

"Formed Plastic Sheets in Furniture and Equipment for Industry." Robert Anderson, Brunswick-Balke-Collender Co.

"The Use of Formed Plastic Sheets in Construction and Architecture," Franz Wagner, Raymond Loewy Associates, Inc.

Management session, moderated by R. L. Davidson, Kurz-Kasch, Inc.:

"The Future of Custom Plastic Molding and Processing," W. R. Evans, Stevenson, Jordan & Harrison, Inc.

"Methods of Estimating Plastic Parts," Ned H. Porte, General American Transportation Corp.

"Estimating Plastic Molds and Dies," Islyn Thomas, Newark Die Co.

"How the Accountant Looks at Costing Procedures of the Plastics Industry," R. C. Jack, Ernst & Ernst.

"How One Molder Translates His Manufacturing Costs into Costs Estimates," John E. Press, Federal Tool Corp.

Other panel participants—John Woodruff, Auburn Plastics, Inc., and Spencer Tucker, Martin & Tucker.

Plastics in Building session, moderated by O. L. Pierson, Rohm & Haas Co.:

"Design Possibilities for Plastics in Building Construction," George Nelson & Co., George Nelson & Co., Inc.

"Increasing Your Market in the Plastics Building Materials Field," George Hermach, Architectural Plastics Corp.

"Plastics in Residential Construction," Ralph Johnson, National Association of Home Builders.

"The Problems that Building Codes Pose to the Plastics Industry," F. J. Rarig, Rohm & Haas Co.

Wednesday morning, November 19

Cellular Plastics session, moderated by Maurice Bailey, National Aniline division, Allied Chemical Corp.:

"Properties of Cellular Plastics Materials," Edwin Edberg, Koppers Co., Inc.

"The Use of Flexible Cellular Plastics in Furniture Applications," Torbin Yates, Kroehler Mfg. Co.

"Applications for Rigid Foams," Albert G. H. Dietz, Massachusetts Institute of Technology.

"Cellular Plastics from the Retail Angle," Leonard W. Johnson, Sears, Roebuck & Co.

"Recent Advances in the Use of Cellular Plastics in the Automotive Industry," Ernest J. Storfer, Chrysler Corp.

International Forum session, moderated by Tino Perutz, Omni Products Corp.:

"The Organization and Function of the Argentine Plastics Federation," speaker from Argentina.

"British World Trade in Plastics," speaker from England.

"Developments in Plastics Machinery and Equipment," speaker from Germany.

"Plastics Applications," speaker from Italy.

"The Development of the Japanese Plastic Raw Materials Mfg. Industry," speaker from Japan.

"Plastics Research in the U.S.S.R.," speaker from Russia.

Plastics in the Appliance Industry session, moderated by Dale Amos, Amos-Thompson Corp.:

Panel of molders and material producers plus representatives from the appliance industry—M. W. Burkhart, Lincoln Molded Plastics, Inc.; Corliss Cummins, Dow Chemical Co.; A. A. Pavlic, E. I. du Pont de Nemours & Co., Inc.; J. N. Ruthenburg, Kent Plastics Corp.; Charles Dyson, Whirlpool Corp.; Fred L. Tarleton, Hotpoint Co.; Harold Bull, Norge division, Borg-Warner Corp.; and Edward Smith, Westinghouse Electric Corp.

Thursday morning, November 20

Merchandising and Distribution of Plastic Products session, moderated by T. S. Lawton, Monsanto Chemical Co.

"The Need for a Stronger Marketing Program in the Distribution of Plastic Products," T. S. Lawton, Monsanto Chemical Co.

"How Plastics Have Served Home Furnishings," W. J. Connelly, Bakelite Co.

Three stages of "Developing Proprietary Plastics to Successful Sales:

'The Innovation of Ideas to Fulfill Consumer Desires,' Ralph F. Hansen, Monsanto Chemical Co.

'Fitting Ideas into Marketable Consumer Products,' Richard A. Winter, Federal Tool Corp.

'The Merchandising and Marketing Steps Necessary to Successful Retail Sales,' Jerry Hanock, Sears, Roebuck & Co."

"Plastic Products from a Retailer's Viewpoint," Frances Corey, Macy's.

"Plastic Products from an Editor's Viewpoint," Charlotte Montgomery, Good Housekeeping Magazine.

"Developing the Custom Molding Market," Elmer Thompson, Prolon Plastics division, Pro-phy-lac-tic Brush Co.

Wire and Cable Symposium

The seventh annual wire and cable sumposium has been scheduled December 2-4, at the Berkeley-Carteret Hotel, Asbury Park, N. J. Held under the auspices of the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J., the program will consist of 23 technical sessions. Schedule of presentations of particular interest to plastics engineers include:

December 2

"Development and Application Notes on 'Thin-Wall' Teflon Insulated Wire and Cable." J. I. Cohn, Inso Products, Ltd.

"Flame Retardant Polyethylene for Wire and Cable." R. C. Graham, Rome Cable Corp. and Dr. C. A. Neros, Diamond Alkali Co.

"Even Count Polyethylene Insulated Cable." F. W. Horn, Bell Telephone Laboratories.

December 3

"Effects of Plasticizers on Dry Blending of PVC Resins." R. A. Park, Firestone Plastics Co.

"Factors Influencing Light Transmission of Black Polyethylene." C. G. Cocks and A. P. Metzger, Battelle Memorial Institute.

"Microdensitometric Determination of Dispersion." W. G. Best and H. F. Tomfohrde III, Bakelite Co.

"Polyethylene-Mechanism of Fracture," P. L. Clegg, S. Turner and P. I. Vincent, Imperial Chemical Industries, Ltd.

"Thermal Stress Cracking of Polyethylene-II." J. H. Heiss, V. L. Lanza, and W. M. Martin, Bell Telephone Laboratories.

"Carbon Black Loaded Cross-Linked Polyethylene for Insulated Wire and Cable." A. C. Bluestein, Anaconda Wire and Cable Co., and Dr. B. B. Boonstra, Godfrey L. Cabot Co.

"Chemically Cross-Linked Polyethylene." E. R. Kerwin, General Electric Co.

SPE New York Section

New York section's first fall meeting was held September 17 at the traditional gathering-place, New York City's Governor Clinton Hotel. More than 150 members and guests crowded the dining hall to hear national president Kenneth R. Gossett review the society's progress during the past few years. Following Mr. Gossett's discussion, Clinton W. Blount, Bakelite Co., spoke on "Plastics Fabrication in the U.S.S.R." He discussed the Russian technical worker, labor management, the various plants that he visited, and augmented his talk with color slides taken in that

country during the recent S.P.I. tour.

"Costing for Injection Molders" was covered during the second half of the general meeting by William Nussbaum, who has devoted himself to plastics costing since 1925. He outlined this phase of business beginning with the blueprint, and tracing it through estimate-recording to the profit-loss statement.

The Vinyl Sub-Group enjoyed a plasticizer forum, moderated by Dr. Irving Skeist, Skeist & Schwarz Laboratories. Members of the panel included Dr. Wesley D. Schroeder, Pittsburgh Coke & Chemical Co., and Arthur C. Hecker, Argus Chemical Corp.

New York's REPPAG gathered to see two Navy Department training films on reinforced plastics, which were presented by I. Reznick, Materials Laboratory, N.Y. Naval Shipyard, Brooklyn, N. Y. The first film was on inspection and quality control and described inspection procedures for glass-polyester laminates. The second film, aimed primarily at shipyard workers unfamiliar with reinforced plastics repair, detailed methods of repair using glass cloth and epoxy resin systems.

The Thermoforming Sub-Group was addressed by A. J. Falkin, Metalmold Forming Co., who covered plaster, wood, phenolic, epoxy, aluminum, and spray-metal molds. Each type was shown to have a place, choice depending largely on the length of the run, labor considerations, and quality of the end product. One of the big advantages of the spray-metal molds is its built-in cooling system, which follows the complexities of the mold pattern. Consideration was given to the possibility of forming smooth blisters with a rough mold by heating higher with shorter cycles. This forms an air-vacuum cushion. Mr. Falkin displayed both molds and finished items.

Society of Rheology

Annual meeting of the Society of Rheology will be held November 5-7 at Franklin Institute, Philadelphia, Pa. Highlighted at the three days session, for which 31 Technical papers are scheduled, will be the presentation of the society's Bingham Medal to Brown University's Dr. Ronald S. Rivlin who is honored for his research in the fields of mechanics of highly-deformable solids, dynamics of high polymer solutions, and electrical circuit theory and physics.

SPE West Coast Conference

Electronic and plastics engineers will get together on October 24 at a regional technical conference sponsored by the Golden Gate Section of the Society of Plastics Engineers, Inc. This all-day conference, which will stress the application of plastics to the electronics industry,

INSTRON

a new dimension in precision plastics testing

Viscoelastic Properties from Stress-Strain Data

Can viscoelastic properties of rubber-like materials be predicted from stress-strain data?

Here's how the problem was approached in a recent study. Stress-strain curves for polyisobutylene were developed on an Instron at several different strain rates and temperatures. Then, points on the curve were reduced mathematically to a single logarithmic stress-strain curve. Dynamic viscosity and stress relaxation modulus obtained from the data were compared with published experimental values.

The result?. You can find it in Instron Bulletin PC-2, which describes this interesting study in full. It is one of many technical articles on advanced testing techniques from reliable, independent sources now available to you in reprint form. Just write

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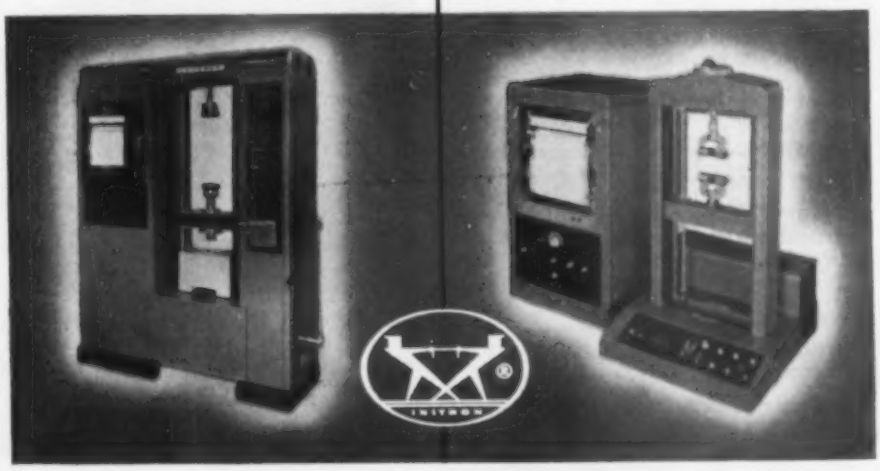


OCT.
1958

DOW

Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

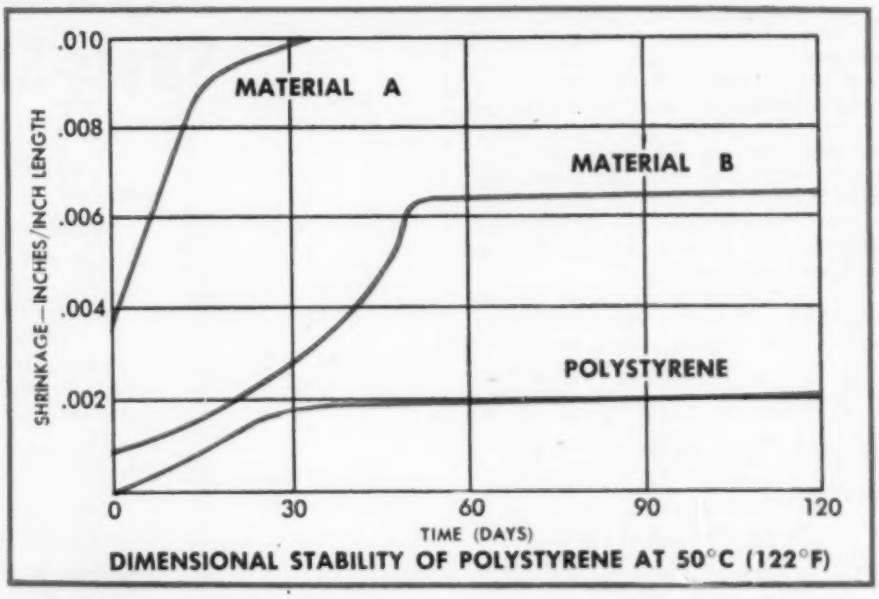
SUPERIOR DIMENSIONAL STABILITY OF STYRON® ASSURES ACCURATE, LASTING FIT

OTHER ADVANTAGES INCLUDE EASY FLOW, HIGH GLOSS FINISH AND HIGH IMPACT STRENGTH

Polystyrene has better dimensional stability than any other thermoplastic material (see chart at right). Even when subjected to elevated temperatures over a period of time, polystyrene retains its dimensional stability better than the two next best materials that could be used.

Styron (Dow polystyrene) is especially suited to molding applications where complex, dimensionally accurate parts are a "must". A case in point is the fan housing shown below. Since both halves of the housing are made from the same mold, dimensional stability is very important. The slightest misfit would detract from the attractiveness of the finished unit. Other reasons for selecting a Styron formulation for this application were its superior impact resistance when tested against an identical metal housing and its high gloss finish.

Styron is available in twelve different formulations which offer a wide range of properties including easy flow, high impact strength, high gloss, and wide choice of colors. If your product can be molded from a polystyrene material, you can be sure a Styron formulation will offer the right combination of properties to mold it properly and economically.



DIMENSIONAL STABILITY OF POLYSTYRENE AT 50°C (122°F)

A continuing series of Plastiatrics studies by Dow Plastics Technical Service Engineers has produced a wealth of information on polystyrene, its dimensional stability, mold shrinkage and thermal expansion. This information is available to you. Address your request for a copy of "Dimensional Tolerances of Polystyrene Moldings" to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1524G.

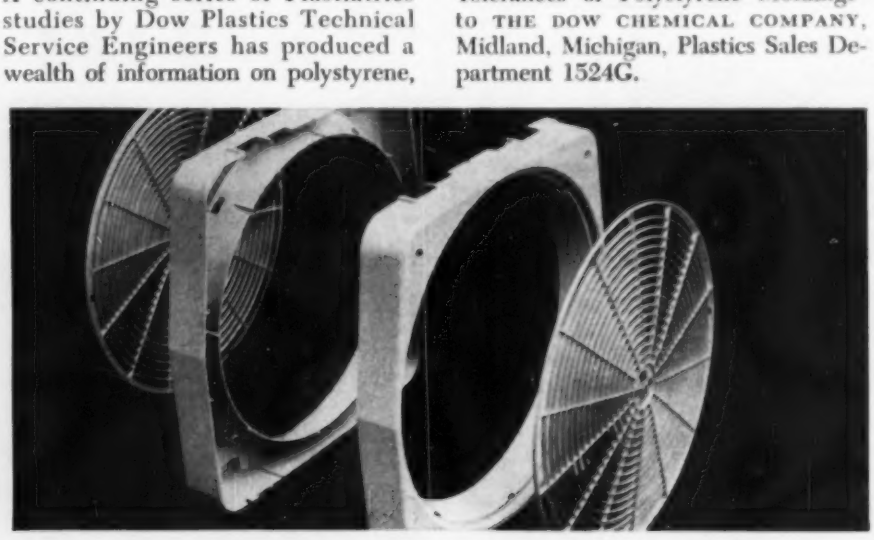
AMERICA'S FIRST FAMILY OF POLYSTYRENES

GENERAL PURPOSE
STYRON ®666
STYRON 689 (Easy Flow)

MEDIUM IMPACT
STYRON 777
STYRON 330 (Easy Flow—Translucent)

HIGH IMPACT
STYRON 475
STYRON 440 (Heat Resistant)
STYRON 440M (Easy Flow)
STYRON 480 (Extra-High Impact)

HEAT RESISTANT
STYRON 683
STYRON 700



YOU CAN DEPEND ON DOW

Be sure to visit the Dow exhibit, Booth 437, Eighth National Plastics Exposition, International Amphitheater, Chicago, Nov. 17-21.

will be held at Stanford Research Institute, Menlo Park, Calif.

Topics and speakers are scheduled as follows: "Materials and Methods of Fabrication for IBM Parts," Rudolph Lorenz, Jr., International Business Machine Corp.; "Influence of Curing Agents on Electrical Properties of Epoxies," John Delmonte and Ken Cressy, Furane Plastics, Inc.; "Molded Plastics for the Electronics Industry," John Robb, American Molding Co.; "Thermoset Laminated Plastics in Electronic Applications," Paul V. Brown, California Fabricon Products; "Foams in Electronics," Roger Jennings, Polytron Corp.; "Electronics Modularization through Plastics," Dan G. Haney, Lunkurt Electric Co.; "Polymer Compositions for the Electronics Engineer," Charles L. Petze, Jr., Delaware Research & Development Corp.; and "Silicone Dielectrics—Versatile Plastic Materials for Environmental Engineering," Donald F. Christensen and Kenneth R. Anderson, Dow Corning Corp.

Advance registration fee for the conference is $9.00, and includes lunch and preprints. Registration and/or information requests should be directed to J. J. Bogner, Chemical Process Co., 1901 Spring St., Redwood City, Calif.

SPE Eastern New England

Approximately 70 members and guests gathered at the Beacon Terrace, Framingham, Mass., to attend the May 15 meeting of SPE's Eastern New England Section. In the absence of president William Nissen, Gin Fong, secretary, presided; while Richard Leary, program committee chairman, introduced the guest speakers.

Lead-off speaker for the evening was Harry E. Connors, Interchemical Corp., who discussed "The Role of Adhesives in End Uses of Plastics Materials." Mr. Connors emphasized the advantages of adhesives from the standpoint of their functional aspects. End-use products were displayed to demonstrate their applications in plastic products.

C. W. Roop, B. B. Chemical Co., spoke on "Potential Applications of Urethane Foams in the Plastics Field." He summarized the present status of urethane foams and followed up with a practical discussion of the many novel applications possible for the plastics engineer. Foaming demonstrations were carried out and sample foam structures were exhibited.

New SPE Section Formed

The first organizational meeting of the North Texas section, Society of Plastics Engineers, Inc., was held May 19 at the Western Hills Inn, located on Route 183 between Dallas and Fort Worth. Co-chairmen of this meeting were E. H. Swazey, Lone Star Plastics Co., and Richard A. Jenkins, Coast Manufacturing & Supply Co.

TAPPI Plastics Conference

The 13th Plastics-Paper Conference sponsored by the Technical Association of the Pulp and Paper Industry is planned for October 20-22 at the Sheraton-Kimball Hotel, Springfield, Mass.

Four half-day sessions will cover the topics of: "Extrusion Coating of Nylon and Linear Polyethylene;" "Performance of New Paper—Thermoplastic Resin Combinations;" "Performance of New Paper — Thermosetting Resin Combinations;" and "Fundamental Aspects of Finer-Plastics Combinations."

Arthur Bronwell, president, Worcester Polytechnic Institute, will deliver the conference banquet-speech discoursing on the subject, "Can We Maintain a Philosophy of Progress?" Following the technical meetings, the delegates will have an opportunity to visit Monsanto Chemical Co.'s plant in Springfield, the Strathmore Paper Mill in Woronoco, and other plants of interest in the Springfield-Holyoke area.

Who's Who Cites ASTE

The American Society of Tool Engineers has received honorable mention in the Second Biennial Citations for Corporate Philanthropy sponsored by "Who's Who in America." For six successive years, ASTE has underwritten scholarships for engineering students who are interested in pursuing tool and production engineering as a profession.

The society sets aside $11,800 annually to provide 22 scholarships; 20 in the U.S., and two in Canada. The grants are divided between colleges and universities; junior colleges and technical institutes; and are distributed geographically as far as possible.

Welders Welcome Plastics

Departing from previous policies, the American Welding Society is including material on adhesive bonding and welding of plastics in Section III of the 1959 edition of "Welding Handbook." This book has long been regarded as the "bible" of the welding industry, and is considered to be the most authoritative work on welding and related processes in existence.

SPE Rocky Mountain Section

The May 22nd meeting of SPE's Rocky Mountain section met at Oxford Hotel, Denver, Colo. where Dr. R. J. Corruccini, National Bureau of Standards, discussed "Low Temperature Properties of Plastics." Dr. Corruccini is chief of the properties of materials section for NBS's cryogenic engineering laboratory. Following the meeting, the group toured Gates Rubber Co.'s extrusion division where the manufacture of vinyl tubes and rubber hose was demonstrated.

Develops Color Standard

Availability of a permanent color standard in the 94% reflectance range has been developed by the Pulverized Limestone Association's technical committee. This standard consists of a plate for measuring high-brightness pigments, and is available at a cost of approximately $60.00. Inquiries should be addressed to the association's secretary, W. Runge, Alabama Calcium Products Co., Gantts Quarry, Ala.

This group was formed to encourage uniform standards throughout industry, and has adopted an official seal to indicate compliance therewith. They have done extensive work in standardizing methods for testing particle size, and currently are engaged in developing test procedures for screen analysis.

SPE Section Splits

SPE National Council has approved the charter for a new section which is being formed from a division of the present Kentuckiana Section which meets at Louisville, Ky. The announcement was made at a recent meeting of the Kentuckiana board of directors where it was revealed that the new group will be known as the Tri-State Section and will meet in the Evansville, Ind. area.

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News of the Industry

Plastics Experts Tour Russia

The U.S.A. plastics industry team has returned from its tour of the U.S.S.R., and has submitted a preliminary report on plant operations, products, and personnel. Plant visitations were made in Karacharov, Kuskov, Orekhovo Zueyevo, Vladimir, Leningrad, Yerevan, Tbilissi, and Grozny, as well as to the Polymerization Research Institute in Leningrad, the Kharkov Research Institute, and the Institute for Elemental Organic Compounds in Moscow.

Standout features of a general nature were reported as being instrumentation, quality of personnel, plant housekeeping and maintenance, and use of the "continuous operation" principle. One possible shortcoming, as reported by the group, was the limited availability of top-grade processing equipment. Russian compression molding plants were top notch, possibly due to the emphasis on industrial rather than consumer goods production. These plants were equipped with batteries of hydraulic presses ranging in size from 100-2,000 tons rated pressure. The smallest plant visited contained 150 presses.

The following table reports Soviet production of plastics materials for 1957:

	pounds
Phenolic and other tar-acid resins	143,300,300
Epoxy and alkyd resins	64,374,904
Silicones	4,850,164
Ureas and melamines	118,608,556
Caprolactam-nylon	28,219,136
Fluorocarbons	44,092,400
Thermoplastics—all types	133,379,510

The Soviet government has been dissatisfied with the progress which has been made in the production of synthetic fibers and plastics, and steps are being taken to extend the capacities of artificial and synthetic fiber producers by 4.6 times; these producing synthetic resins by 8 times; and those producing synthetic rubber by 3.4 times. A seven-year plan calls for the building or reconstruction of 257 enterprises of chemical and related industries. Over 100 billion rubles have been allocated to this program.

The U.S.S.R. has 33 universities and 765 other institutions of higher learning, with a total of 1,966,000 students. The Academy of Sciences governs or influences the work of more than 250,000 scientists, and has under its direct supervision, in the chemical division alone, 10 research institutes. The Chemical Committee operates 26 research institutes. In the Leningrad Polymerization Institute alone, more than 1,100 workers are engaged in research on polymerization chemistry including pilot plant work. Extent and quality of research work impressed the visitors very favorably.

Eastman Makes Polypropylene

A process, developed at Tennessee Eastman's research laboratories in Kingsport, Tenn., is being used by Texas Eastman to produce polypropylene at Longview, Tex. Pilot plant quantities are being tested by Eastman, and no date has been set for commercial availability. The process by which the material is made is said to involve new catalysts for which Eastman holds the patents. The Longview plant produces polyethylene, and for some time has been turning out high-purity propylene, the base material for the new plastic.

Cary-Lewis Form Subsidiary

Cary Chemicals, Inc., of New Brunswick and Flemington, N. J., and its Canadian sales representative, Lewis Specialties, Ltd., Montreal, Que., have announced the formation of a jointly owned affiliate—Carlew Chemicals, Ltd. A plant has been made available in St. Remi, Que., which will produce PVC compounds for the Canadian wire and cable industries, as well as general extrusion. Additional facilities are provided for the eventual production of other plastic and elastomeric compounds.

Lewis will continue to sell Cary's Blacar PVC resins and other materials, plus the new Carlew line of Polycor PVC compounds. Carlew officers have been announced as follows: W. B. Jonah, president and treasurer; Kenneth B. Cary and George F. Blasius, vice presidents; and J. J. Gadbois, secretary.

To Phenolics and Back Again

One of the oldest plastics known, phenol-formaldehyde, is regaining prominence through the advent of the space age. Used in combination with silica fibers, phenolic resins are proving to be the only known materials capable of withstanding the frictional heats to which missile nose cones are subjected on re-entering the atmosphere—over 10,000° F.

One such compound was developed by H. I. Thompson Fiber Glass Co., Los Angeles, Calif., and named Astrolite. Consisting of the silica fibers and Monsanto's Resinox SC-1008 phenolic resin, one pound of the material resists burn through better than 15 pounds of steel. As the surface heats up to about 3,000° F., the

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phenolic begins to vaporize thus exposing the silica fibers. Though silica softens, it will not burn and remains intact until hot enough to evaporate. Evaporation, in turn, has a cooling effect. Another advantage offered by the material is its poor heat conductance, which means that high surface temperatures cannot easily penetrate into the mass.

In a practical demonstration, a ½-inch thick steel plate and an Astrolite panel the same size but ¼ the weight were subjected to a 5,000° F. blast. The steel burned through in 42 seconds, as opposed to 142 seconds for the resin-silica combination.

Celanese-ICI Joint Venture

Celanese Corp. of America and Imperial Chemical Industries, Ltd. have announced the formation of a jointly owned subsidiary to produce a polyester fiber in the U. S. Trademark for the fiber will be Teron, and tentative name for the new company is Lindun Fibers Co. Options have been taken on several plant sites, and construction of the initial unit should begin shortly.

Under joint agreement, the new firm will be the beneficiary of all polyester fiber research and development findings by both I.C.I. and Celanese, as well as rights to patents of both parent firms. A British development, polyester fibers were discovered by Calico Printers' Association, Ltd., and rights to manufacture and sale, except in the United States, were turned over to I.C.I. The trademark was Terylene. U. S. rights were sold to E. I. du Pont de Nemours & Co., who markets the fiber under the trade-mark Dacron.

Teron will be produced in both staple and filament form, and should figure prominently in wool and cotton blend fabrics. The new plant is expected to have an eventual capacity of 40-million pounds annually. Since its original commercial introduction in 1949, more than 350-million pounds of polyester fiber have been sold throughout the world.

Moffitt Elected Hooker Head

Acting on recommendation of R. Lindley Murray, board chairman of Hooker Chemical Corp., the board of directors elected Thomas E. Moffitt, Hooker president, to succeed Mr. Murray as chief executive officer of the company. Mr. Murray has held the office since 1955, and Mr. Moffitt was elected president last year. Mr. Murray will continue as chairman of the board until December 1, 1959, after which time he will be available for consultation on all company matters. In the interim, he will be concerned chiefly with the recently-formed research and development policy committee.

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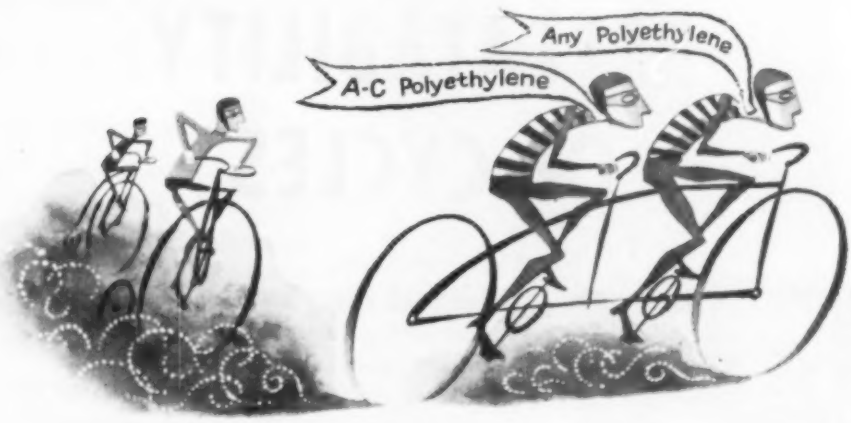

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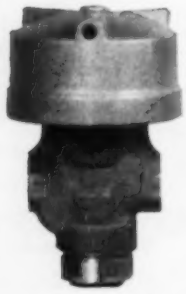

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Akron Polymer Lecture Group

The twelfth annual series of lectures sponsored by the Akron Polymer Lecture Group opened on August 14 with a talk by W. F. Watson, British Rubber Producers Association, on "Polymeric Reactions Induced by Mechanical Deformation." The talks are held under the auspices of the University of Akron, and will continue through May 1. Other dates, topics, and speakers are scheduled as follows:

October 10, "A Soluble Catalyst for the Polymerization of Ethylene," David S. Breslow, Hercules Powder Co.; November 7, "Stereospecific Olefin Polymers," Waller George, Celanese Corp. of America; December 5, "Polymerization in Canal Complexes," John F. Brown, Jr., General Electric Co.; January 9, "Chain Configuration and Elasticity," Paul J. Flory, Mellon Institute; February 6, "Mechanical and Physical Properties of Diisocyanate-Linked Elastomers," Thor L. Smith, Jet Propulsion Laboratory, California Institute of Technology; March 6, "Helical Structures in Crystalline Polymers," R. E. Highes, University of Pennsylvania; April 3, "Viton Fluorocarbon Elastomers," J. R. Pailthorp, E. I. du Pont de Nemours & Co.; and May 1, "Plastics Can Be Tough," P. M. Elliott, Naugatuck Chemical, division of U. S. Rubber Co. Inquiries should be addressed to Dr. K. W. Scott, Research Laboratory, Goodyear Tire & Rubber Co., Akron 16.

Plastic Foam Production Soars

The production of cellular or foamed plastics almost doubled in 1957, increasing 97% to a new high of 31,500,00 pounds. These figures have just been released by Joseph R. Morton, newly elected chairman of SPI's Cellular Plastics division, and president of Morton-Withers Chemical Co. Mr. Morton also predicted that 1958 figures should reach 50,250,000 pounds for a gain of 59% over last year. Foams involved include vinyl, urethane, polystyrene, phenolic, and polyethylene.

Flexible and rigid vinyl foams accounted for approximately ⅙ the 1957 figure and, although they are expected to show a million-pound gain, will account for but 10% of the total market. Larger gains are predicted for foamed styrene; a five-million pound gain to 20,000,000. Flexible and rigid urethane foams should more than double their production from 12-million pounds to 25-million.

It was also announced that the cellular plastics industry has developed and approved specifications and methods of test on flexible vinyl foam, flexible urethane foam, and rigid cellular materials. These specifications and test methods were approved recently by ASTM, as well as the joint ASTM-Society of Automotive Engineers committee on automotive rubber. Copies can be obtained from the Society offices.

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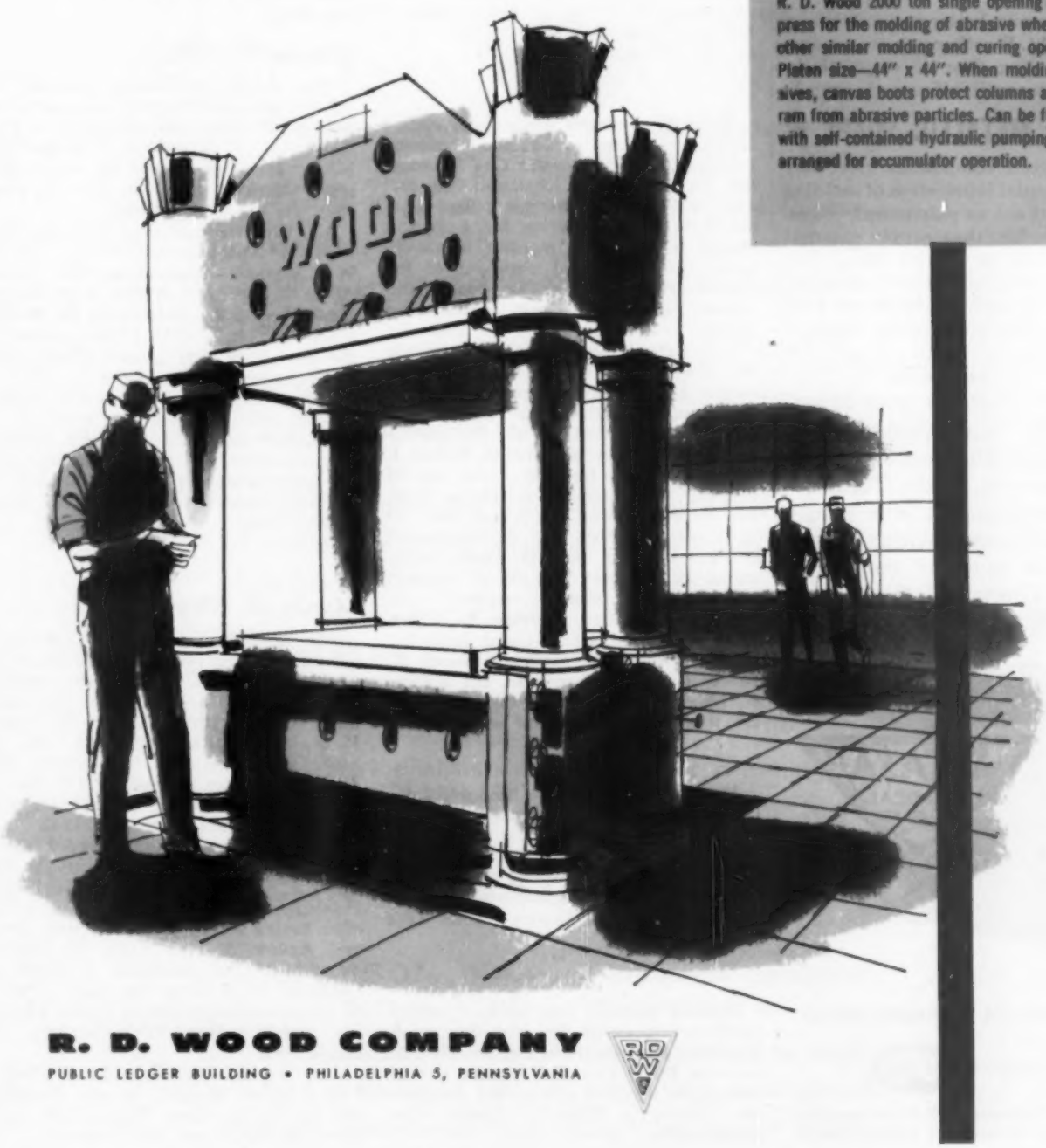

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Names in the News

John Aquino

John Aquino has been appointed district manager, Chicago area, for Acme Machinery & Mfg. Co., a Chicago firm. A five-year employe, Mr. Aquino is a mechanical engineer.

Ralph K. Gottshall was recently elected chairman of the board and re-elected president of Atlas Powder Co., Wilmington, Del. As board chairman, he succeeds **Isaac Fogg,** who has retired after nearly 46 years of service. Mr. Fogg will remain a director, a member of the finance committee, and chairman of the committee on audit. The board also elected **Edward J. Goett,** senior vice president, to the position of executive vice president. Still other changes include the election of **Edward J. Massaglia,** former general manager of operations for the chemicals division, as vice president and general manager of the newly-consolidated chemicals division. **Robert J. Reilly,** assistant treasurer, was elected treasurer and secretary succeeding **Preston W. Parvis,** who has retired after 47 years with the firm. Mr. Parvis remains a board member. **John H. Leary,** assistant to the president, was elected assistant treasurer and assistant secretary; and company controller, **Norman E. Miller,** was elected an officer. Other re-elected officers include vice presidents **James R. Frorer, Charles C. Gammons,** and **William C. Lytle;** and **Arnold J. Fiedler,** assistant treasurer and assistant secretary.

Donald W. Stewart has been appointed Chicago district sales manager for National Vulcanized Fibre Co., succeeding **James R. Kallaher,** who has been named to the newly-created post of general sales manager for the company. Mr. Stewart formerly served as Boston district sales manager.

Thomas Kramer has been appointed hydraulics specialist for Erie Engine & Mfg. Co., Erie, Pa. A former associate of Aldridge Pump Co., Mr. Kramer is well known in the hydraulics field and has been serving as EEMCO's Eastern sales representative.

New assignments for **John J. Berry, Melvel W. Duncan,** and **Hugh E. Klein** have been announced by Union Carbide Chemicals Co. Mr. Berry, former Chicago district manager, becomes manager of the Kansas City district. He replaces Mr. Duncan, who is now manager of the St. Louis district. Mr. Klein, former product manager for the new chemicals group, is now district manager of the Chicago district.

OBITUARY

Warren W. Otis

The former production manager of Allied Chemical's National Aniline division, Warren W. Otis, died August 11 at East Aurora, N. Y. A resident of Ridgewood, N. J., Mr. Otis retired in April after nearly 40 years of service with the company. He was 62 years old.

Mr. Otis was graduated from the University of Michigan in 1918 with a B. S. in Chemical Engineering. He joined Allied that year as a chemist at the Marcus Hook plant, and transferred to the Buffalo plant in 1924. In 1931, he was moved to the New York City general offices. Title of production manager came in 1947.

A member of the ACS and Phi Lambda Upsilon, Mr. Otis also was president of the Ridgewood Board of Health. Funeral and interment was at Kendallville, Ind., his home town. Mr. Otis is survived by his wife, Evelyn, a daughter, and three grandchildren.

Marvin O. Shrader

The supervisor of organic chemicals research for Pittsburgh Coke & Chemical Co.'s research and development department, Dr. Marvin O. Shrader, died suddenly on September 21 in St. Clair Memorial Hospital, Pittsburgh, Pa. A native of Bishop, Va., he received his B. A. from Berea College in 1937, M. A. from Syracuse University in 1939, and Ph.D. from Yale University in 1942.

Dr. Shrader had been awarded numerous U. S. and foreign patents in the field of industrial chemistry. He joined Pittsburgh Coke & Chemical in 1952, after having served previously with General Aniline & Film Corp. He was a member of the American Institute of Chemists, ACS, Alpha Chi Sigma, Sigma Xi American Association of Textile Chemists, and the New York Academy of Science.

Surviving Dr. Shrader are his wife, Lulu Higgins Shrader; a son, Donald; and a daughter Linda Kathryn. He also leaves six sisters and three brothers.

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News from Abroad

New Decorative Material

A new type of decorative panel, offering novel possibilities to architects, installers of lighting arrangements, decorators, etc., has appeared on the French market. Named Luminail, it consists of sheets of glass fiber mat between layers of certain high polymers; is translucent; and can be supplied in an unlimited range of colors. To enhance its decorative effect, the surface is studded with polymer crystals which catch the light. Among its more useful properties claimed are that it is almost unbreakable, is a good thermal insulator, and resists aqueous chemical solutions (except strongly basic solutions), oils, hydrocarbons, fatty acids, and alcohols. Insoluble in water, its moisture resistance is low, and it is not affected by temperatures in the range of —40 to +120°C.

Available in various dimensions and in panes which can be assembled to form artistic designs, suggested uses for the panels are for windows in churches and chapels, decorative elements in buildings, partitions, decorative walls, translucent screens and advertising signs.

Plastics Cargo Boats

Russia reportedly proposes to build plastic cargo boats with tonnage of 100-150 tons as well as motor-boats carrying up to 100 passengers for the coasting trade. At present a certain number of plastic motor-boats and barges of 10-15 tons in capacity are said to be under construction in Moscow. A number of advantages are claimed for these vessels as follows: built with double hulls having empty space between they are of small draught; since they offer less resistance to friction, are faster than steel boats; and since they are said to be extremely buoyant they will not sink even when filled with water. Specific gravity of the polyester resin from which they are made is 80% less than of steel and the resin will stand temperatures ranging from 70 to more than 200° C.

Plastics Sales in Britain, 1957

United Kingdom sales of plastics materials in 1957 reached a total of 393,000 tons as compared with about 338,000 tons in 1956 and 316,000 tons in 1955. During the first three quarters of 1957, the increase over 1956 worked out at 18-19%; this declined to 10% in the fourth quarter, so that the increase for the whole year came to about 17%. Exports were 106,000 tons in 1957, or 14% above the 1956 figure. Imports at 33,000 tons were 10,000 tons higher than the year before and, combined with sales of locally-produced materials, resulted in an increase in consumption of some 53,000 tons (about 20% higher than 1956). Figures for both exports and imports reached record levels in the latter part of 1957.

The following table gives details of sales in tons, in the years 1954-1957, inclusive:

	1954	1955	1956	1957
Thermosets:				
Alkyds	33,700	35,900	39,600	43,500
Aminoplastics	43,000	47,000	48,900	50,500
Casein plastics	2,100	2,700	2,700	1,700
Phenolics and cresylics	62,100	71,200	64,600	66,700
Polyesters	400	900	2,200	3,200
Other thermosetting materials	1,900	2,500	3,500	4,700
Total:	143,100	160,000	161,400	170,200
Thermoplastics:				
Cellulose plastics	11,200	11,900	11,400	12,300
PVC (solutions, compounds, sheet, rods, etc.)	41,500	46,900	47,200	66,200
Polystyrene	21,400	21,300	23,800	31,100
Vinyl acetates			11,000	12,500
Others, including acrylics, polyamides, p.t.f.e. polyethylene, and PVC polymers	55,600	76,400	82,800	100,900
Total:	129,700	156,400	176,200	223,000
Grand total:	272,900	316,500	337,600	393,100

The rate of increase in sales of thermoplastic materials in 1957 was higher than in the three preceding years; compared with 1956, it amounted to nearly 27%. Thermoplastics, especially PVC, polystyrene and polyethylene, were mainly responsible for the favorable results last year. Higher sales in alkyds, aminoplastics, and polyesters mainly accounted for the improved showing of thermosets in 1957. In 1954 and 1955, vinyls and acetates were included among "other thermoplastics."

Norsomix Compounds

The French concern Houileres du Bassin du Nord et du Pas du Calais, is now featuring Norsomix compounds. These are pastes consisting of chopped glass fibers mixed with an unsaturated polyester to which have been added a catalyst, an inert filler, and pigment. The compounds are available in six colors (natural, white, gray, black, yellow and red), and can be molded by compression, transfer, or injection methods. The products are claimed to have high tensile, flexural, tear, impact and shear strengths, as well as excellent electrical properties and unusual dimensional stability, which give them a wide range of application in the electrical field and the automobile industry, because of electrical properties and unusual dimensional stability.

Moplen at the Milan Fair

For those interested in plastics, one of the centers of attraction at the 36th Sample Fair held in Milan, Italy, during April 12-27, 1958, was the section of the Montecatini pavilion devoted to products of Moplen (polypropylene). The arrangement of the exhibits was calculated to impress upon the visitor the wide range of applications for this material, articles being grouped according to the following branches: automotive, mechanical, and textile industries; electrical appliances and articles for the home; and electrical and chemical industries.

A surprising variety of small and large parts were shown, including head-light cases and carburetor elements for motor cycles, bobbins for the textile industry, different types of gears, brightly colored housings for vacuum cleaners, ventilators, boxes for sterilizing hypodermic syringes; Moplen-insulated cables for radar, television, and ordinary uses; radio cases and magnetic recorders; bottles for blood plasma, bed pans, trays, tubing, etc., for surgical and hospital purposes; chemically-resistant valves, joints, tubing, parts for centrifugal pumps, industrial brushes etc.; thin sheets in various colors; and a refrigerator door.

Russia-Japanese Talks

According to the Japanese press, purchasing agents from Soviet Russia have been interviewing Japanese firms in connection with planned Soviet purchases of Japanese chemical plant material for synthetic fibers and resins, plastics, fertilizers, synthetic rubber, and coal tar colors. The total value involved is said to run into the equivalent of some hundreds of millions of dollars. Both the Japanese Government and local Japanese industrialists are understood to be sceptical about the matter.

Kaetolon, New Cellulosic

Kaetolon (APK—U) is a new French cellulose acetate that has recently been put on the market. Unusual mechanical properties are claimed for it, comparable with those of acetobutyrate and far superior to those of cellulose acetate powders now available. Some of the average values reported are: impact resistance (kg/cm./-sq.cm.) of plain samples, 175; on notched samples, 31.5. Modulus of elasticity (kg./-sq.cm.), is 179; flex resistance: 630 kg./sq.cm.; breaking load, 324 kg./sq.cm.; and elongation at break, 35%.

The outstanding properties besides high impact resistance are claimed to be low moisture absorption and high dimensional stability in presence of heat and moisture. The material, produced in a wide range of hardnesses, readily can be injection molded or extruded, and complicated thick- or thin-walled shapes can be produced without any difficulty.

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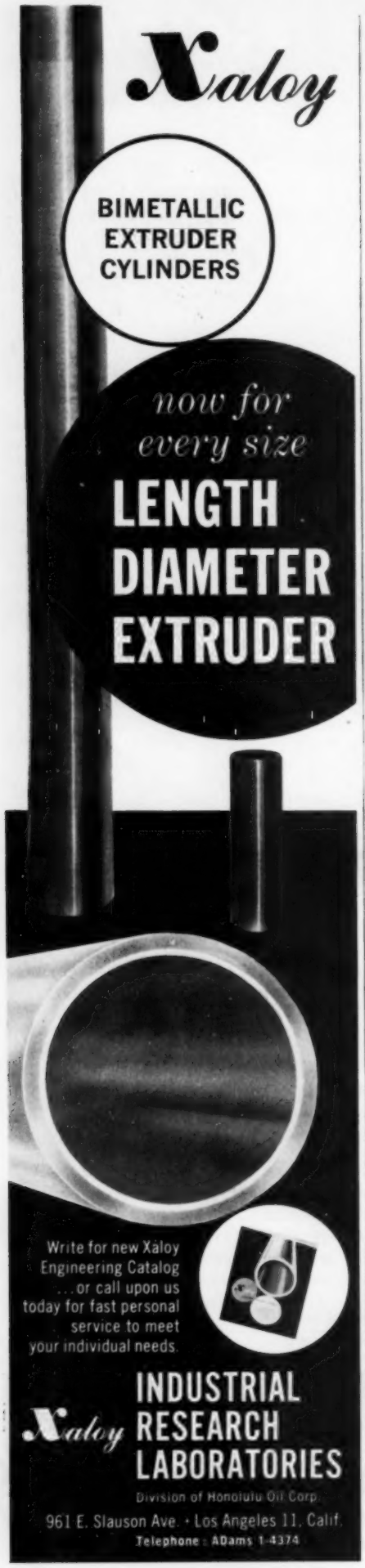
NATIONAL LEAD COMPANY, 111 Broadway, New York 6, N.Y.

In Canada: CANADIAN TITANIUM PIGMENTS LIMITED, 630 Dorchester Street, West • Montreal.



New Materials

Write item numbers on Readers' Service Card to obtain more information.

Strong Specialty Adhesive

An adhesive for bonding vinyl compounds to nylon or polyester-fiber fabrics has been developed by E. I. du Pont de Nemours & Co. This material, known as as NVD, combines a solvent, plasticizer, vinyl resin, and an isocyanate to form an adhesive which gives bond strengths in the neighborhood of 20 pounds per inch. The cured adhesive is flexible, thus permitting treated fabrics to be used in such applications as truck, boat, and hatch covers, as well as other applications where flexing is common.

The mixture is prepared in a drum or mixer by blending dioctyl phthalate, vinyl resin, methyl ethyl ketone, and methylene bis (4-phenylisocyanate). Should an indefinite shelf-life be desired, the isocyanate need not be added until ready for use. Its presence will cause the compound to lose 15-20% of its adhesiveness after 10 days.

Treatment can be by dip coating, although a horizontal spreader also can be used. Closely woven fabrics require a minimum of one ounce of adhesive per square yard if maximum bond strength is desired. After application, the fabric is passed through a drying oven where it is given a two-minute cure at 350° F.

In spread coating, the vinyl compound is applied in the normal manner using temperature-time cycles customary in fusing operations. For laminates, however, both the film and the adhesive coated fabric should be completely dry and preheated to temperature of 350° F. Actual lamination is accomplished at normal production speeds. Physical properties of fabrics coated with NVD adhesives follow:

	Spread Coat		Laminate		
	Nylon*	Dacron*	Dacron*	Scrim Nylon	Nylon*
Base Fabric wt.**	2.1	2.2	2.2	1.4	5.0
Color of coated fabric	Olive Drab	Olive Drab	Green	Blue & White	Green & Orange
Adhesive pick-up**	1.7	1.0	1.0	1.3	3.6
Film thickness, mils	—	—	6/6	4/4	4/4
Coating wt.**	6.7	11.2	—	—	—
Coated fabric wt.**	10.6	14.5	—	—	—
Laminated fabric wt.**	—	—	14.6	9.3	16.7
Adhesion, lbs./in.	24	17-24	19	9-14	14-23
Tongue tear strength, warp, lbs.	7.5	8	6.8	6.2	16
Tensile strength, warp, lbs., grab.	167.0	200.0	—	143	407

* Close woven
**Ounces per square yard

All data tabulated above were gathered from fabrics coated on commercial-scale equipment. It will be noted that tensile strengths essentially are unchanged; while tear strengths are down somewhat since this factor is inversely proportional to adhesion. Certain adhesion values are reported in ranges since they vary with quantity and type of plasticizer; color and type of pigment in coating or film; and amount of moisture in and on the fabric. Lower values are reported for scrim nylon, because this material has a surface area approximately one-fourth lower.

Readers' Service Item 145

Contact Pressure Adhesive

A high strength epoxy adhesive requiring only contact pressure to make a durable bond that will not delaminate has been formulated by Marblette Corp., and is being marketed under the trade name Maraset resin 532. Developed primarily for joining metals to metals, this adhesive also forms a superior bond with other material combinations including glass, plastics, wood, and masonry.

The resin is a two-component system which can be used for general purpose or high temperature applications depending on the type hardener used. In the first case, it is blended with the company's Hardener 37 and cured at room temperature over-night, or at 200° F. for one hour. An aluminum-to-aluminum bond made under these conditions exhibited a tensile shear strength of 2,000 psi. after the room temperature cure, and 3,800 psi. after the one-hour heat cure. For high temperature applications, the resin is mixed with Hardener 38 and given a three-hour heat cure at 180° F., followed by three more hours at 250° F.

Readers' Service Item 146

Extrusion Grade Polyethylene

A high density polyethylene whose melt strength permits fabrication of large parts by sheet extrusion, calendering, and vacuum forming techniques, has been formulated by Phillips Chemical Co. Designated Type 2 Marlex 50, this material exhibits certain characteristics that are superior to those of the four other polyethylenes marketed by this company.

Characterized by a low melt index, Type 2 shows improved creep properties, increased toughness, and greater environmental stress cracking resistance. A summary of its physical properties includes:

Malt index	0.2
Impact strength, ft.-lbs./in. notch*	14.0
Environmental stress cracking, hrs.**	60
Brittleness temp., 50%, °F.	<—180
Tensile strength, (20 in./min.), psi.	4,400
Elongation, %	30
Density	0.96
Softening temp., °F.	260
Stiffness (flexure), psi.	150,000
Hardness, Shore D	68

*½ x ¼-inch bar.
**Bell Laboratories test, hours to 50% failure.

Readers' Service Item 147

Expanded Polystyrene Coating

A two-component, thermosetting, coating liquid that can be applied to foamed polystyrene to render it resistant to shock, impact, and abrasion, thus increasing its structural possibilities, has been developed and placed on the market by Protective Coatings, Inc. Known as Styrokote, this material also can be used as an adhesive for bonding polystyrene to itself or to other surfaces such as glass, wood, masonry, paper, cardboard, plastics, etc.

Consisting of a base material and an activator which are blended on a 10:1 or 6:1 basis, depending on whether weight or volumetric measurements are used, Styrokote has sufficient adhesive strength so that individual pieces can be butted together and edge-cemented to form large sheets and panels. Extra rigidity can be imparted simply by applying a coating layer to the panel. Alternate layers of fiber glass cloth and Styrokote also can be applied to polystyrene panels to form an armour-casing that is almost impossible to break.

Applied with a squeegee, brush, straightedge, or trowel, Styrokote sets in a few minutes to a tough, weather-resistant skin. Built-in colors can be obtained by adding special color pigment additives prior to activation. The unmixed components have an indefinite pot-life but, once blended, the mixture should be used within 30 min.

Readers' Service Item 148

Fast-Curing Polyester Resin

A low viscosity, slightly thixotropic polyester resin, which fast-cures to form a rigid member, has been added to American Cyanamid Co.'s Laminac series of polyester resins. Formulated specifically for fabrication of boats and other large structures, Laminac 4105 permits fabricators to lay-up two to three parts in each mold during a normal working shift.

Light blue in color and of medium reactivity, this resin will not sag when used in vertical lay-ups with glass mat or woven roving. It has good wetting properties, and a fast gel which is controllable by varying the concentration of methyl-ethyl ketone peroxide. Moldings usually can be removed from the mold 1-1½ hours after the first resin used in the lay-up has gelled. This, of course, depends on the complexity of the part and the ease of mold release. Other characteristics of this resin include:

Viscosity*, 77°F., poises	8
Specific gravity	1.1
SPI cure characteristics:	
Gel time, min.	1.25
Time to peak exotherm, min.	2.25
Peak exotherm temp., °F.	400

*Brookfield Model RVF, Spindle #1, 10 rpm.

Readers' Service Item 149

VANSTAY®

Vinyl heat and light stabilizers

Our trade mark of 12 years standing came into being with VANSTAY L, the first nontoxic light stabilizer for Vinyls.

Today, the VANSTAY line includes a number of materials developed to keep pace with Industry's demands for higher temperature Vinyl protection in process and in service.

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Expandable Polystyrene Beads

A line of expandable polystyrene beads, tradenamed Pelaspan, are being marketed by Dow Chemical Co. The beads range in size from one to 1½ mm. in diameter, and contain a halide-free blowing agent which permits their use as foam-in-place materials.

Pelaspan should be prefoamed before molding articles of intricate shape, thin vertical section, or products with a uniform density less than five pounds per cubic foot. Under application of heat, it expands to fill the confining mold with a rigid, unicellular foam having low thermal conductivity, density, water absorption, and water vapor transmission characteristics. Strength-to-weight ratio is high, and the material can be handled without concern for toxicological effects. The beads may be colored by dry-blending or dyeing. In either case, the colors produced will be light pastel in shade and mottled in appearance.

Close control of molding conditions is needed for optimum physical properties that vary with density. Products molded from Pelaspan 8, the general-purpose beads exhibit approximate physical characteristics, as follows:

	Density, lbs./cu.ft.	
	2	9
Compressive strength, 5% deformation, psi.	26	160
Flexural strength, psi.	52	300
Tensile strength, psi.	40	160

Readers' Service Item 150

Flame Resistant Laminate

A flame resistant laminate, available in both standard and copper-clad forms, has been placed on the market by National Vulcanized Fibre Co. Known as Phenolite Grade XXXP-467, the laminate consists of a paper base bonded with a modified phenolic resin. It meets all NEMA requirements for XXXP stock and is recommended for use in critical electrical and electronic applications where fire hazards impend.

A hot punching material having high insulation resistance and low moisture absorption, Phenolite Grade XXXP is available in two sheet sizes measuring in inches: 39 by 47, and 39 by 39. Thickness range is from 1/32-¼ inch. Some properties of specimen 1/16-inch stock include:

Flexural strength, psi.	23,200
Water absorption, % gain	0.30
Density	1.38
Dissipation factor, 1 megacycle	0.25
Dielectric constant, 1 megacycle	4.06
Rockwell Hardness, M scale:	
Cold, 25° C	118
Hot, 60 sec	70
Hot, 120 sec	8.9
Cold Flow, div. change	8-11
Flame resistance, extinguishing time, sec	99

Readers' Service Item 151

Flexible Enamel Finish

A non-toxic, organic enamel which cures to form a flexible, glass-like surface on treated linear polyethylene and polypropylene is being marketed by C. L. Rowe Corp. Designated Nylene 1901, this material is available in clear glossy and pigmented transparent and pearlescent colors.

The cured finish has excellent scuff and mar resistance, is inert to solvents, chemicals and soaps, and sets up a barrier to vapor and moisture transmission. Nylene 1901 can be applied by spray, dip, or coating machine after treating the plastic with gas flame or chromic acid. It lends itself to reduction with xylol, toluol, or high-flash naphtha, and can be cured between 200° F. and the softening point of the plastic. While the cycle will vary with the method of application and type of equipment, a recommended bake would be at 200-250° F., for 10-20 minutes.

Readers' Service Item 152

Styrene Graft Polymer

A styrene graft polymer, which is said to exhibit higher flex resistance, better resiliency, and lighter color than other impact polystyrene materials, has been developed by Foster Grant Co., Inc. Trade-named Fosta Tuf-Flex, this material is virtually colorless in its natural state; readily accepts pigment dispersions; and has high heat and color stability. A summary of its physical properties includes:

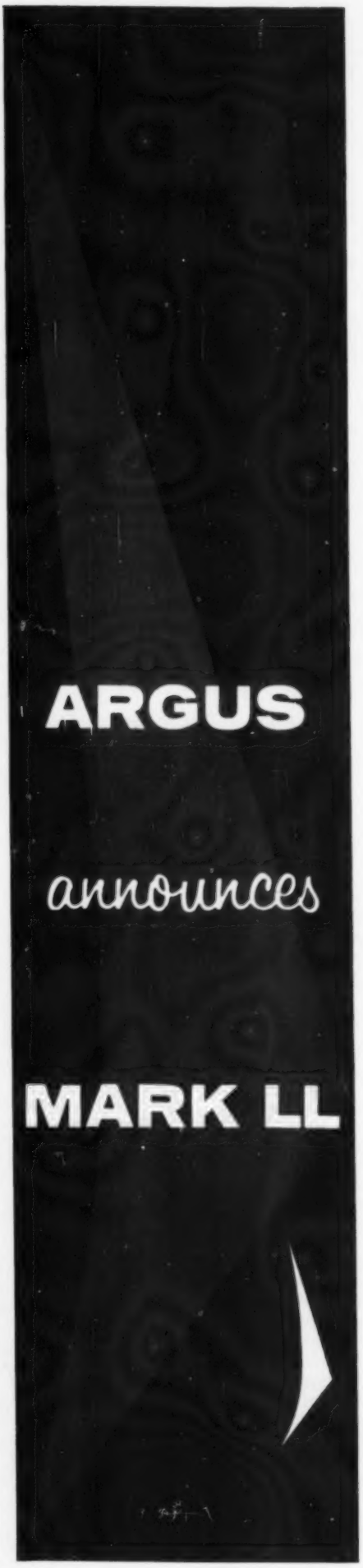
		ASTM Test Method
Specific gravity	1.04	D792-50
Izod Impact strength, ft.-lbs./in. notch	0.9-1.1	D256-54T
Tensile strength at fail, psi.	4,000-5,000	D638-52T
Elongation at fracture, %	30-40	D638-52T
Modulus of Elasticity, psi.	3-5 x 10^5	D638-52T
Flexural strength at yield, psi.	5,500-7,000	D790-49T
At fail, psi.	no failure	D790-49T
Heat distortion temp. at 264 psi. fiber stress, °F.	165-177	D648-45T
Mold shrinkage, in./in.	0.003-0.005	D955-51
Water absorption, %	0.008-1.0	D570-54T
Hardness, Rockwell	50-60	D785-51
Dielectric constant, 10^6 cycles	2.50-2.60	D150-54T
Power factor, 10^6 cycles	0.0004-0.0010	D150-54T

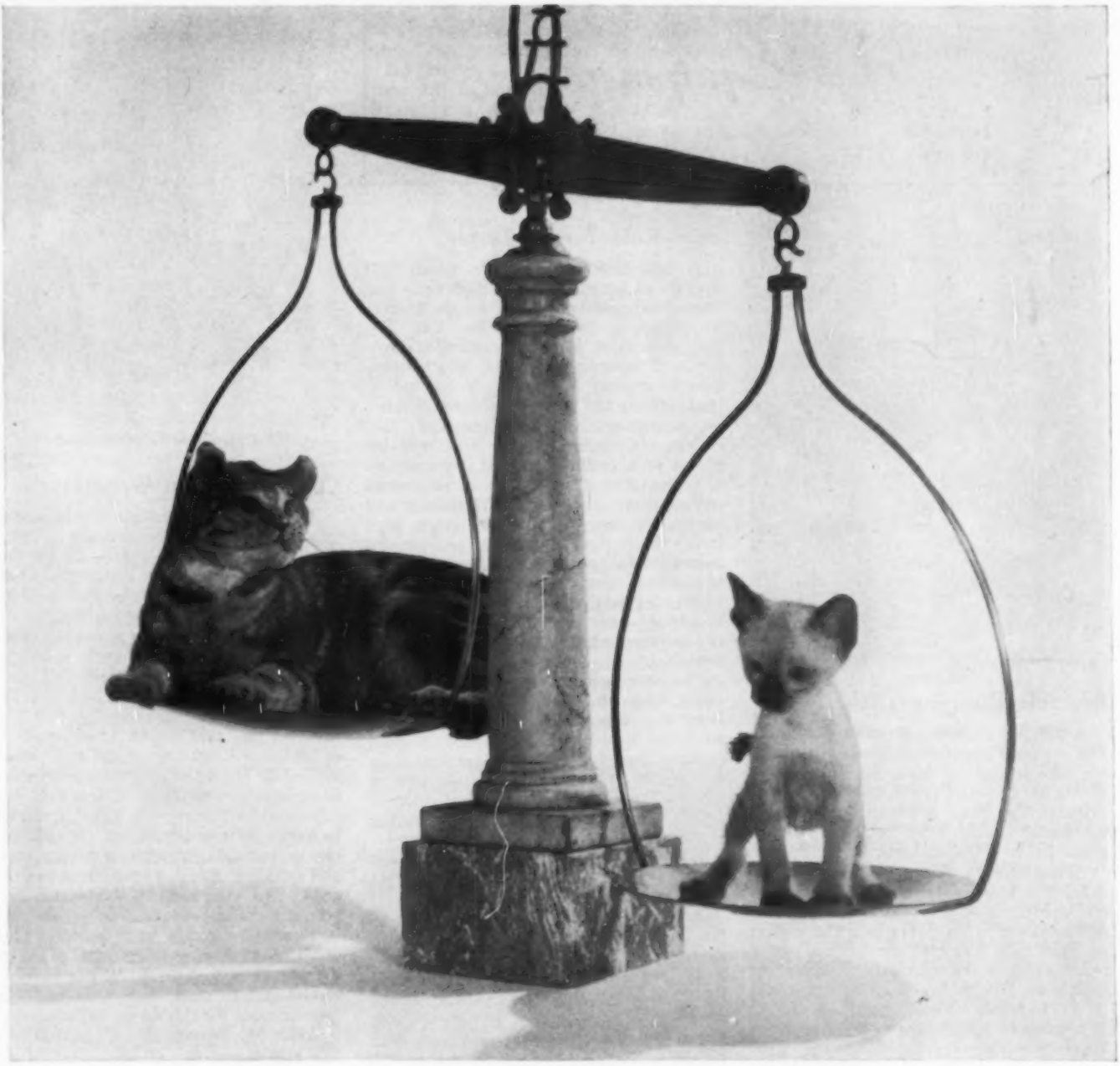
Readers' Service Item 153

Calcium Carbonate Extender

A dense, precipitated calcium carbonate, tradenamed Carbium, used as an extender for flat wall paints of both alkyd and resin emulsion types, has been introduced by Diamond Alkali Co. This material also can be used as a filler for PVC resins since it meets all the requirements for cost, uniformity, processability, and color stability for these applications.

Readers' Service Item 154





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New Equipment

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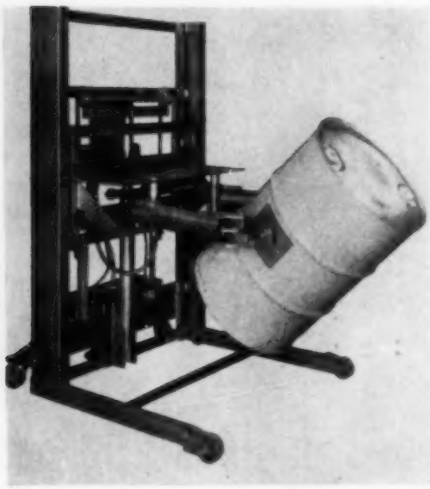


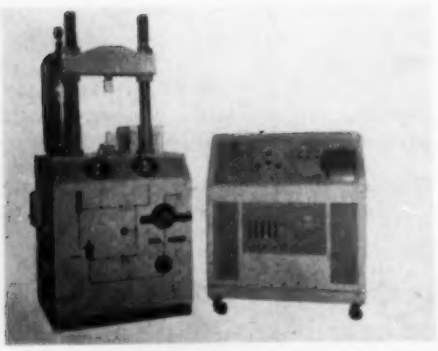
Colson Corp.'s dumping lifter.

Portable Dumping Lifter

A portable dumping lifter, incorporating two separate hydraulic systems for grasping and lifting the load, has been introduced by Colson Corp.'s special products division. The lifter is caster-mounted, will tilt drums through a 90° arc, and handles loads up to 1,000 pounds.

A hand-operated pump actuates the hydraulic system governing the clamping mechanism, while a battery-operated pump performs the lifting operation. The unit is designed with a safety factor of six, and a relief valve is incorporated into the lift system to prevent overload. Lifting speed is 15 feet per minute, total lift is 52 inches, and the clamps will operate to within six inches of the floor. The arm-spread accommodates diameters from 18-38 inches, but other dimensional limits can be specified. Grab-shoes are rubber-lined to protect smooth surfaces.

Readers' Service Item 155



Allegany high rate tensile tester.

High-Rate Tensile Tester

A high-rate tensile tester which will operate at constant deformation rates has been developed and placed on the market by Allegany Instrument Co., Inc. The unit consists of remotely controlled loading and recording sections, which combine to produce a photographic record of load, strain, and time deflections pictured on a cathode ray oscillograph.

Load is applied to the specimen by means of a hydraulic piston, actuated by a motor driven pump whose discharge communicates alternately with the top and bottom of the cylinder. A return pipe from the cylinder-bottom contains an automatically controlled valve, a rate control orifice, and an oil reservoir from which the pump takes suction. The cylinder-top also communicates with an accumulator where hydraulic pressure is stored.

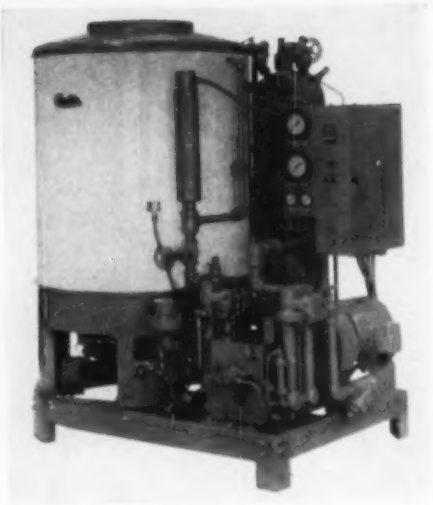
The automatic valve in the return line closes when the pump is started and oil from the reservoir forces the piston upward. At the top of the stroke, a latch engages the piston rod, the pump stops, and the automatic valve reopens. One of the tension or compression jaws is attached to the top of the piston, while the other is connected to a load transducer.

When the latch is tripped, the hydraulic pressure in the accumulator forces the piston down to apply a load to the sample. The rate of downward motion is controlled by the rate control orifice, which determines how fast the oil can flow back into the reservoir. A cathode ray oscillograph picks up the electrical output of the load transducer on its vertical axis, while a linear motion potentiomenter, fastened to the piston rod, applies the strain component along the horizontal axis. A camera, facing the cathode ray tube, records the movement of the electron beam as it traces a complete load-strain record of the sample under test. The face of the tube is calibrated for strain, load, and time which enables the user to compute the rate of deformation.

Other characteristics of this tester in clude:

Cross head adjustment, max., in.	20
Nominal ram travel, in.	4
Load range, max., lb./min.	0-5,000
Min.	0-20
Deformation rate, max., in./min.	8,000
Min.	2
Accuracy, % of full scale range	2

Readers' Service Item 156



Clayton steam generator.

Oil-Fired Steam Generator

An oil-fired, controlled circulation-type steam generator, incorporating a single pass, continuous, water tube-coil, has been introduced by Clayton Mfg. Co. Designated Model RO-160, the unit automatically adjusts its output to load fluctuations, and is provided with an electronic photocell which shuts off the fuel within two seconds if ignition or flame should fail.

Fuel oil is pressure atomized in a high velocity, forced draft-type burner. The welded steel combustion chamber is insulated with refractory cement and a water-wall coil. Tubing is protected from direct flame impingement by a stainless steel liner.

Wound in a horizontal spiral formation to assure positive circulation, the coil feeds into a vertical accumulator where steam and entrained liquid are separated centrifugally. The accumulator also serves as a reservoir for unevaporated water. Sediment is removed through an automatic blow-down. A circle-ring thermostat, protecting the generator coil, shuts off the burner if partial or total water failure occurs. Other specifications for this model include:

Boiler hp., normal	160
Maximum	175
Heat output, normal, BTU/hr.	5,356,000
Maximum	5,858,125
Steam output, normal, lb./hr.	4,600
Maximum	5,000
Operating pressure, psi.,	
200 psi. (R-160-2)	65-195
250 psi. (R-160-25)	65-245
300 psi. (R-160-3)	65-295
Motor, hp.	10
Volume of firebox, cu. ft.	12
Heating surface, sq. ft.	270

Readers' Service Item 157

Cylindrical Electric Oven

A cylindrically-shaped electric oven, called Circ-O-Therm, has been introduced by Hevi-Duty Electric Co. The unit draws 600 watts, and is wired for connection

to a 115- or 230-volt power source. Four heaters, located between the outer and inner shells, deliver uniform temperatures up to 250° C. Variations are held by a bulb-type thermostat to within ±1°.

Of insulated, double-wall construction, the oven's steel outer shell is finished in neutral hammertone green, while the inner is made of aluminum to facilitate heat diffusion. The door is built similarly, and is fitted with a corrosion-proof hinge and an explosion-relief type latch. Three perforated aluminum shelves are provided.

Temperature readings are shown on a mercury thermometer, and a neon pilot light indicates when the power is on or off. A power selector switch permits high or low input. Over-all dimensions, in inches, are: width, 20; depth, 18; and height, 23. Working chamber dimensions, in inches, include: diameter, 15; and depth, 13.

Circ-O-Therm oven.

Readers' Service Item 158

Reciprocating Ram Extruder

Teflon extrusions can be manufactured competitively through use of a reciprocating ram extruder, developed by Davis-Standard Div., Franklin Research Corp. The unit will handle low cost powdered-type compounds 1, 5, and 7, and delivers extrusions up to ½-inch outside diameter.

In operation, successive charges of Teflon are forced by the ram through an electrically heated die which is provided with a thermocouple for temperature measurement. When insulating wire, the conductor is fed through a tube running through the center of the ram. A short cooling water section cures the Teflon rapidly enough so that take-up units can be located adjacent the extruder. Over-all dimensions in inches include: length, 70¾, height, 53¾, and width 31½.

Davis-Standard Teflon extruder.

Readers' Service Item 159

Solenoid Valve Series

A series of general-service solenoid valves, designated Type Q (normally closed) and Type QR (normally open), have been introduced by J. D. Gould Co. Fully automatic, the valves feature two-way operation, and are packless, bronze-bodied, and piston-pilot operated.

They are designed for use with heavier liquids, air, and gases to 400 psi.; steam to 200 psi.; and temperatures to 450°F. Standard features include heavy duty coil assembly, unbreakable piston rings, waterproof epoxy resin coils, and guided pilot valve seat to insure positive seating with minimum wear. High temperature coils at slight extra cost can be specified.

Gould's general service solenoid valve.

Readers' Service Item 160

Flow Coating System

A flow coating system, designed for applying lacquer, paint, or enamel to small parts, is being marketed by William A. Finkbeiner, designer and fabricator of specialized equipment. The system incorporates a coating tank where the materials are sprayed onto the product, and a rotator where they are subsequently dried.

Model 814 Rotator.

William A. Finkbeiner's Model 122 Flowcoater.

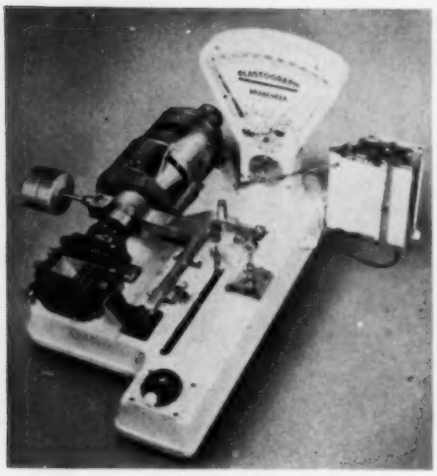
The parts to be coated are spring-clipped to a reel, which is inserted in the tank and rotated manually by a crank and coupling device. Beneath the tank and electric motor drives a positive displacement pump to force the coating liquid through a 25-micron filter and ultimately to a horizontally-mounted spray manifold. Approximately three gallons of liquid are needed, and all parts that can be mounted on the reel are coated in 20 seconds.

After the coating process, the reels are transferred to an electrically-operated rotating device which will accommodate eight. Here, slow rotation permits an even flow-out of any excess fluid on the parts. If forced drying is required, the reels can be placed on a four-wheeled truck for a batch oven cure, or mounted on a conveyor for a continuous baking process.

While normally built to customer's specifications, a standard model F-122 Flowcoater with Model 814 Rotator is available. The coating tank measures 55 by 28 inches. It is supported on an angle iron stand 30 inches high, and when the lid is closed, over-all height is 45 inches. The rotator is 72 inches long, and 36 by 72 inches high. Motors and starters are explosion-proof, and are wired for connection to a 220 volt, 60 cycle, single-phase power source.

Readers' Service Item 161

THE ONE PLASTOGRAPH DESIGNED EXPRESSLY TO MEASURE THE PROCESSABILITY OF ALL PLASTICS!



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Plastics Applications

Write item numbers on Readers' Service Card to obtain more information.

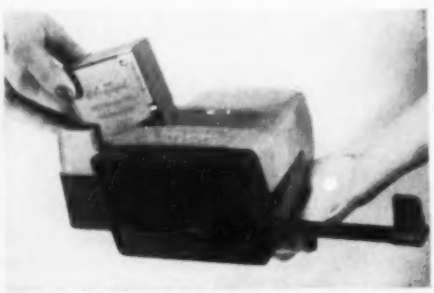
Swan Humidifier's wind tunnel made from Campco S-300.

Blow Wind, Blow

Wind tunnels for home, school, and industrial humidifiers are being manufactured from Campco S-300 modified styrene sheet. This styrene-rubber combination was selected because of its low moisture pick-up, high impact strength, light weight, good dimensional stability, and its ease and inexpensiveness in forming and fabrication.

The tunnel acts as a cover for an evaporating drum, fan, and motor; and at the same time channels air in the proper direction. The material does not rust or corrode, and can be hole-punched and readily machined. No installation problems are involved except to plug in an electric cord and fill the pan with water. Hood design incorporates a built-in funnel for quick and easy refilling. Campco S-300 is manufactured by Chicago Molded Products Corp., and the end-product originates at Swan Humidifier Co., Inc.

Readers' Service Item 162



Ultramatic slide viewer.

Urea Slide Viewer Housing

A magazine-fed slide viewer, said to be the first such automatic device for hand viewing color-transparencies, is being manufactured from Plaskon Urea, a product of Allied Chemical Corp.'s plastics and coal chemicals division. Introduced by Airequipt Mfg. Co., and custom molded by Shaw Insulator Co., the Ultramatic viewer is available with lamp housings to accommodate either battery or a.c./d.c. power sources.

The viewer utilizes magazines for quick loading and easy storage of transparencies, which are viewed in continuous sequence by moving a handle in and out for each slide. Daylight viewing is possible when the lamp housing is removed and, on the a.c./d.c. model, a wheel protruding from the side of the housing controls the brightness of the image and permits adjustment for optimum contrast.

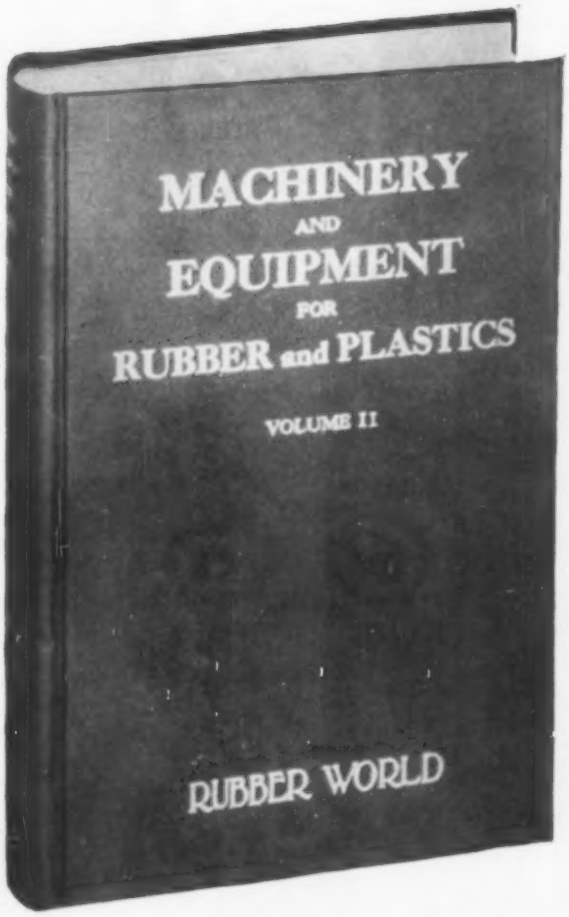
Readers' Service Item 163

Overnite case edged in Silvatrim.

Plastic-Metallic Foil Trim

Tenite butyrate and aluminum foil have been combined through a special lamination-extrusion process to make a high-lustre edging material known as Silvatrim. The plastic sheath protects the foil against tarnishing and the molding permanently retains its brilliance even though exposed to salt water, weathering, and other deteriorating elements.

NOW AVAILABLE



VOLUME 2

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and

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Covering

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9—Power Transmission
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Plastics Applications (Cont'd.)

Developed and manufactured by Glass Laboratories, Inc., Silvatrim has a high impact strength and is widely used as a decorative and protective edging on luggage, lampshades, automobiles, marine windshields, and household appliances. It can be form-fitted in continuous strips; nailed or cemented to flat surfaces; and mitered with ordinary household shears.

The trim is flexible, dimensionally stable, and cannot crack, chip, or peel. Various metallic lustres such as silver, chrome, gold, and copper are achieved by extruding crystal clear, or transparent-colored resins about the foil.

Readers' Service Item 164

Portable marine battery box.

Marine Battery Box

A portable marine battery box, made from American Cyanamid's Laminac polyester resin, is being fabricated by Filmaline Products, Inc. for Perkins Marine Lamp and Hardware Corp. Equipped with an adjustable canvas-strap carrier, the box measures 9½ by 12 by 10½ inches, enabling it to fit most marine batteries.

The box is resistant to impact, corrosion, chips, and dents. Its turquoise-colored lid has a ⅛-inch wall section, and is made from sisal-filled Laminac polyester resin glass. The body, which is white, has a typical wall section of 0.070-inch, and is molded of white Laminac reinforced with glass mat.

Readers' Service Item 165

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Housewife's Built-In Delight

A combination mixer, blender, meat grinder, knife sharpener, and fruit juicer which can be built into a kitchen countertop has been introduced by NuTone, Inc. Called the In-Built NuTone Food Center, it operates through a built-in, 340-watt motor which can be installed level with the countertop.

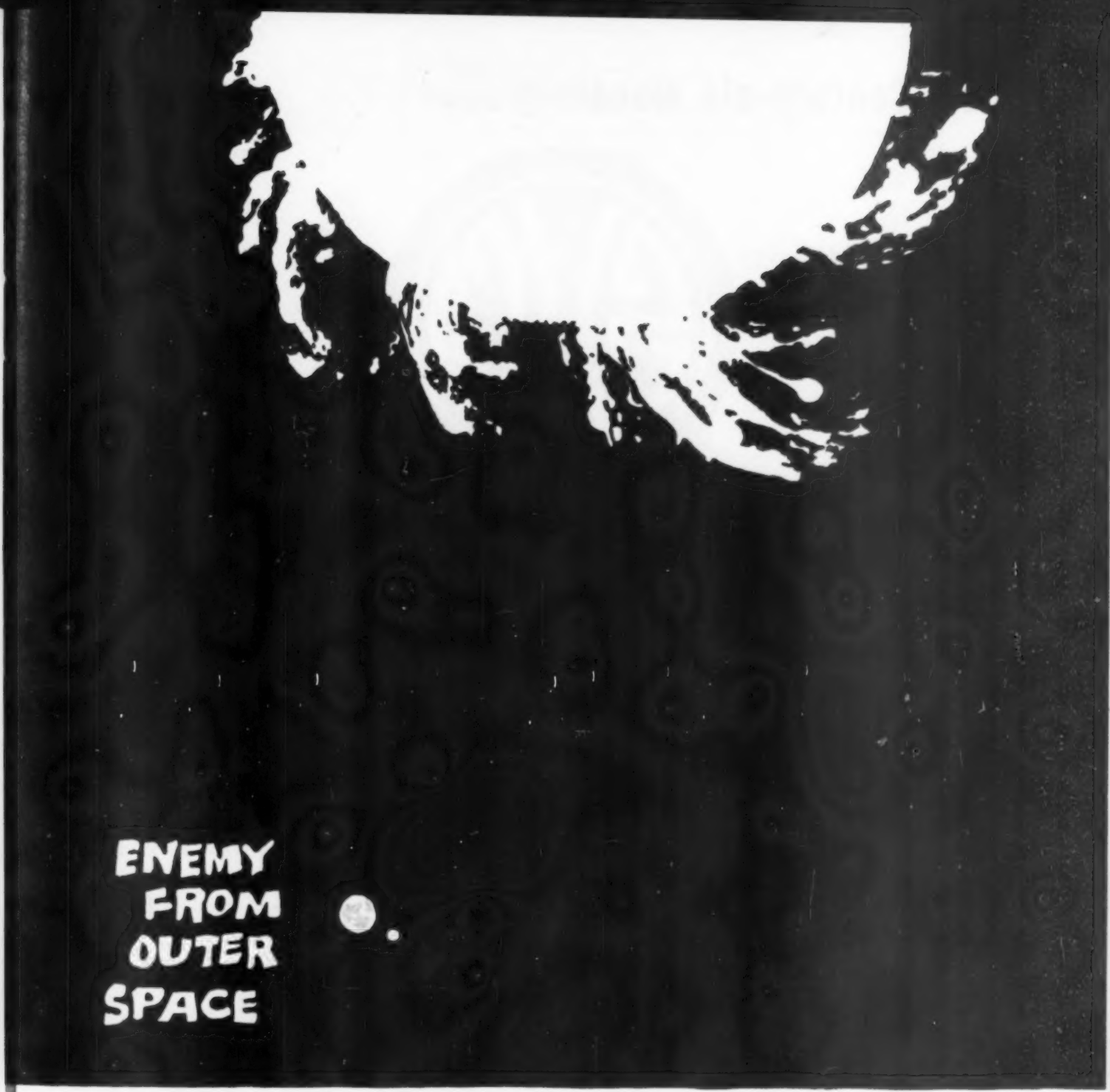
From the plastics viewpoint, the 3½-quart white bowl for the mixer and juicer is molded of American Cyanamid's Cymel melamine by the Prolon Plastics division of Pro-phy-lac-tic Brush Co. Dent-proof and light, the bowl is designed for easy holding.

Cymel melamine mixing bowl.

Readers' Service Item 166

Bicycle Speedometer

An air pressure-operated speed indicator incorporating Rohm & Haas Co.'s Plexiglas acrylic plastic in its body and dial face, has been introduced by Sinko Mfg. & Tool Co. Called Flight Leader, the unit is clamped onto the handlebars and operates



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Flight Leader speedometer.

on the same principle as air speed indicators used in commercial and military aircraft.

When the bicycle is in motion, air enters a small orifice perpendicular to the dial face. After deflection around a tube, it impinges against a fan blade whose motion actuates the spring-mounted needle. The dial face, which is calibrated from zero to 50 in units of five, is injection molded of clear Plexiglas. The back of the instrument is molded of bright red Plexiglas serving as a contrasting background for the white calibration marks.

Readers' Service Item 167

PVC Core Tube

Petroleum engineers can cut shipping costs by replacing the heavy metal containers used for shipping core samples with a light-weight, high-impact PVC tube which has been specially designed for this purpose by Kraloy Plastic Pipe Co. Known as the Cor-Tainer, this unit is available in a standard size, 36 inches long with a 4.067-inch inside diameter. One end is permanently sealed, while the other is threaded to receive a pipe cap. The tube is air-, oil-, and water-tight, has a shipping weight of seven pounds, and will not rot or corrode under adverse conditions. Special sizes can be obtained on request.

Kraloy's PVC Cor-Tainer.

Readers' Service Item 168

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heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

Water	0.21 %
1% Soap	3.45 %
Mineral Oil	2.10 %

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

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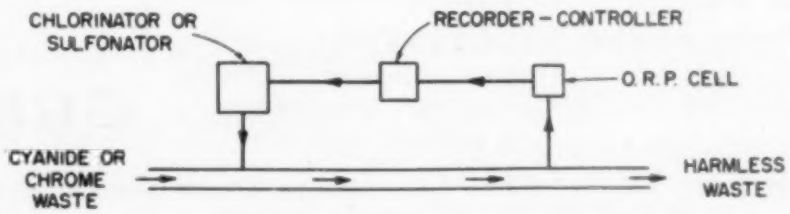

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New Literature

Write item numbers on Readers' Service Card to obtain more information.

"Petrothene Polyethylene—A Processing Guide." U. S. Industrial Chemicals Co. 100 pages. The entire story of polyethylene from basic chemistry through the fabrication of end products is given in this comprehensive, well-illustrated bulletin. Style is clear and concise, and data is correlated in logical sequence. About 20 pages are devoted to properties of the resins and the products, and the 50-page section on processing techniques covers extrusion (all types), calendering, injection molding, blow molding, thermoforming, and compression. This booklet could well be considered a must in the polyethylene processor's file.

Readers' Service Item 170

"A Guide for Converters." Film division, American Viscose Corp. 8 pages. Prices, characteristics, and general uses of Avisco cellophane are given, noting the competing grades. Code designations and information on the approximate thickness and area of Avisco cellophane also are included.

Readers' Service Item 171

"Foreign Licensing—Questions and Answers." Pegasus International Corp. 16 pages. This booklet presents advantages and disadvantages of licensing, partner selection, importance of securing patents, setting royalty fees, evaluating potential markets, and the establishment of foreign subsidiaries or reciprocal agreements.

Readers' Service Item 172

"Shell Molding with Dow Corning Silicone Parting Agents." Dow Corning Corp. 4 pages. In addition to describing water-dilutable Dow Corning 8 Emulsion and the solvent types, the brochure explains how to break-in patterns and how to clean them before use.

Readers' Service Item 173

"Dapon Resin Decorative Laminates." No. 19. FMC Organic Chemicals division, Food Machinery & Chemical Corp. 13 pages. A homopolymer of diallyl phthalate, the resin is used to give moisture-proof, solvent-proof, abrasion-resistant laminates which can be applied directly to a variety of rigid cores at low pressures. The bulletin describes the impregnation of various papers, formulations, solvent systems, and internal release agents used, as well as optimum laminating conditions and properties of the finished laminates.

Readers' Service Item 174

"The Goose That Laid the Golden Egg." U. S. Industrial Chemicals Co. 24 pages. In addition to a fable with a moral, the booklet describes what can go wrong with polyethylene housewares, practical considerations, and eight ways to ensure profits.

Readers' Service Item 175

"GE Silicones." CDS-129. General Electric Co., Silicone Products department. 8 pages. Actually a condensed catalog, this bulletin serves as a bibliography to other G-E literature on specific silicone uses such as: damping fluids, heat-transfer fluids, lubricants, cosmetics, polishes, antifoam agents, release agents, masonry, paint additives, electrical insulation, textile finishes, ceramics, and rubber.

Readers' Service Item 176

"Micro-Milled Color Paste Dispersions for Polyester Resins." Plastic Molders Supply Co., Inc. 6 pages. This new color chart shows 24 standard paste dispersions arranged as paint sample cards. Instructions are given for formula mixing for gel coats, impregnation, or premix.

Readers' Service Item 177

"Water Economizer — One Answer to the Industrial Water Problem." WE-2A. Mayer Refrigerating Engineers, Inc. 4 pages. The bulletin describes a unit for recirculating and cooling water, explains its use, and shows how it can give increased quality control while reducing water consumption by 95%.

Readers' Service Item 178

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Book Reviews

"Enciclopedia Annuario della Materie Plastich." Second Edition. Edited by *Revista Materie Plastiche;* published by L'Industria, both of 8 Via Farnet, Milan, Italy. Vinyl, 8½ by 12 inches; 1200 pages; price 2,500 Lire plus postage 1,400 Lire.

The success of the first edition, reviewed by PLASTICS TECHNOLOGY in November 1957, p. 936, which was exhausted in a few months, has led Materie Plastiche to lose no time in presenting a second edition. Like its predecessor, it is illustrated and includes several colored plates, and is bound in plastic sheet. The encyclopedia proper contains 37 chapters on synthetic resins, fillers, plasticizers, stabilizers, solvents, etc.; eight chapters on machinery and equipment; 13 chapters on processing methods; and 19 chapters on applications. All the material has been brought up to date and two new chapters have been added; one on polycarbonates, and the other on plastics for agriculture.

This Year Book provides a classified guide to suppliers of materials, equipment for the plastic industries, and manufacturers of plastics products. The number of names listed has gone up from 1,400 in the first edition to over 2,200. It also includes over 6,400 proprietary names, with addresses of manufacturers.

"Development of Thermally Stable Silicone-Containing Resins, Part 2." L. W. Breed, F. Baiocchi, and C. C. Bolze, Midwest Research Institute for Wright Air Development Center, U. S. Air Force. Order PB 131715 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 76 pages. Price, $2.00.

This work is the continuation of an earlier project aimed at preparing thermosetting polyarylenesiloxanes for use as laminating resins and structural adhesives. They should be usable at temperatures over 500° F., and should be resistant to oxygen degradation, ozone, and water.

Laminates were prepared using experimental monomers, including the use of tetrahydrofuran as a solvent in the Grignard synthesis. Studies were made of the variables effective in the formation of laminates from silicone resins and glass fabric, and of the effect of treating finished silicone resins with catalyst solutions.

"Coordination Polymers, Part 2." W. C. Fernelius and others, Pennsylvania State University for Wright Air Development Center, U. S. Air Force. Order PB 131649 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 71 pages. Price, $2.00.

Although coordination polymers can be prepared, the problem of obtaining them with high molecular weights remains unsolved. Preparation of a silicone monomer by reaction of dimethyldichlorosilane with the sodium salt of acetylacetone failed; however, a series of monomeric bis(acetylacetoneate) dialkoxy titanium compounds was synthesized.

A series of salts of dithiophosphates was prepared, and efforts were made to prepare an analogous bifunctional ligant. Polymeric materials were produced from what was probably a mixed ester of a dialcohol and monoalcohol. Investigations of similar compounds with other donor atoms led to the conclusion that compounds with various combinations of oxygen, sulfur, and amido nitrogen do not coordinate well, except for the dithio compounds.

"Development of Fluoro-Silicone Elastomers, Part 3." G. W. Dyckes, Peninsular Chemresearch, Inc., for Wright Air Development Center, U. S. Air Force. Order PB 131425 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 63 pages. Price, $1.75.

Some promising fluoroalkyl silane monomers and polymers were prepared for use as high-temperature and aircraft fuel-resistant elastomers. Hydrolysis reactions were carried out, and the constant boiling products were characterized. Polymerization of the cyclic hydrolysis products to elastic homopolymers was carried out with active metal catalysts.

Copolymers with octamethylcyclotetrasiloxane were effected using potassium hydroxide as a catalyst. Improved yields were obtained through reaction with hydrogen fluoride, but percent conversion remained relatively low.

"Plastics Study Group of the Building Research Institute." Building Research Institute, division of Engineering & Industrial Research, National Academy of Sciences-National Research Council, 1145 Nineteenth St., N. W., Washington, D. C. Paper, 8½ by 11 inches, 127 pages. Price, $3.00.

This book is actually the illustrated proceedings of a two-day meeting held by the BRI Plastics Study Group at Washington University, St. Louis, Mo., on September 17 and 18, last year. There are two separate parts: "Plastics for Roof Construction," and "A Case Study—Plastics in a New Building."

The first section includes 12 technical papers covering insulation, vapor barriers, flashings, surfacing materials, and skylights. Two other papers of note are "Architectural Requirements for Roofing Materials" by Anthony Ferrara, McLeod & Ferrara, Architects; and "Roof Structures Constructed of Plastics Materials" by Joseph R. Passonneau, Washington University.

The second section of the book is a case study of the use of plastics in the construction of Monsanto Chemical's new inorganic chemicals laboratory in St. Louis, with reports by company personnel and architects on design, management objectives and supervision, comparative costs of plastics and conventional materials, processes involved in gaining building code acceptance, and a report by the building contractor on job management and organization.

Polymerization Through Coordination." J. C. Bailar, Jr., W. C. Drinkard, Jr., and M. L. Judd, University of Illinois for Wright Air Development Center, U. S. Air Force. Order PB 131517 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 52 pages. Price, $1.50.

Aim of the program was to obtain plastic materials which are stable from —80 to 800° C. or, as an alternative, substances which are stable and plastic at the higher temperatures but not at the lower. Properties of metal-containing polymers were studied, and these materials were found to have excellent heat and chemical stability. Chelate polymers containing bis-diketones, bis-hydroxyquinolines, beta-hydroxyethylpolyamines, and bis-alpha-amino acids were tested, as well as some of the polymeric phthalocyanines. The latter showed most promising results, with molecular weights up to about 30,000.

"Statistical Summary No. 2—Supplement to the Chemical Statistics Handbook." Fourth Edition. Manufacturing Chemists Association, Inc., 1625 Eye St., N. W., Washington 6, D. C. Paper 8½ by 10¾ inches, 73 pages. Price $1.00.

This supplement to the 1955 fourth edition brings up to date production figures for a selected list of inorganic and organic chemicals, employment, wages, hours, earnings, wholesale prices, production indexes, and data from the Bureau of Census. All information and trends for the chemical industry are compared with all manufacturing.

Abstracts of Important Articles

Materials

"Rigid, Transparent PVC—Lucoflex T," M. J. Bost, *Ind. Plastiques Mod.*, 10, 3, 1 (March 1958).

The successful production by Saint-Gobain, Paris, of Lucoflex T, a rigid, transparent PVC, is ascribed to the combination of a process of bulk polymerization and the use of an organic-tin stabilizer. The properties of the material are compared with those of a Lucoflex C11, polystyrene, Rhodoid and Plexiglas. (In French.)

"Graft Copolymers—Part 3," S. H. Pinner and V. Wycherly, *Plastics, (London)*, 23, 244, 27 (Jan. 1958).

Synthetic methods of grating polymers are compared and the fine structure of graft copolymers is explained and taken into account in the discussion of the properties of the products. Finally, the possible applications of fusible and infusible graft copolymers are considered.

"Properties and Applications of Fluorine Polymers," H. Reinhardt and J. Szurrat, *Gummi u. Asbest*, 10, 9, 498 (Sept. 1957).

The preparation and applications of Teflon 100 x, Hostaflon (polytrifluorchlorethylene of the German Hoechst concern), Kel-F elastomers and oils, Fluorolubes, Poly-FBA, Silastic LS 53, and Viton are discussed and the properties compared. (In German.)

"Industrial Methods of Bulk Polymerization of Methylmethacrylate and Styrene," N. Grandis, *Materie Plastiche*, 23, 8, 650 (Aug. 1957).

Review of methods of polymerization, with special reference to bulk polymerization of methylmethacrylate and styrene. Tables indicate conditions for the different processes of polymerizing vinyl monomers, and give data on the characteristics of methyl methacrylate and styrene monomers. (In Italian.)

"Coloring High Polymers," C. Mayaud, *Ind. Plastiques Mod.*, 10, 3, 47 (March 1958).

Compared with dyes used in the textile industry, the number of pigments for plastics is very limited. A total of some 30 mineral and organic pigments at present are available for plastics, about half of which are in widespread use, while the rest are limited to special purposes. How the various products are used for different plastics, the extent to which they satisfy requirements, and the direction that research should take to complete the range of colors for plastics are discussed. (In French.)

"Polyester Resins Reinforced with Non-vitreous Materials," M. Lenzini, *Materie Plastiche*, 23, 9, 755 (Sept. 1957).

Where exceptional mechanical properties and finish are not required, the use of cotton, jute, or sisal for reinforcing polyester moldings reduces costs because the filled materials are cheaper and have lower specific gravities. The process and equipment needed for making pre-forms of these fibers are described. (In Italian.)

"Ionic Polymerization," G. Martin Guzman, *Rev. Plasticos*, 8, 47, 266 (Sept.-Oct. 1957).

Review of cationic and anionic polymerization and copolymerization of vinyl and acrylic monomers, based on American and British literature. (In Spanish.)

"Possible Application of Radiations for Obtaining Ethylene Polymers," J. Sancho, *Rev. Plasticos*, 8, 47, 273 (Sept.-Oct. 1957).

The author briefly reviews the progress of radiation techniques to produce polymers, giving consideration to the economic possibilities of the process, with the stated object of arousing his countrymen to the need for work in this direction. (In Spanish.)

"Interchangeability of PVC Plasticizers. A Contribution to the Problem of Plasticizer Efficiency," K. Saoechkert, *Kunststoffe*, 48, 3, 103 (March 1958).

The literature offers few useful figures for the amounts of different plasticizers that can be used to achieve the same effect. Chiefly on the basis of American work on efficiency concentration, the author has compiled a table showing the relative efficiencies of various commercial plasticizers compared with DOP=100. This table has deficiencies, but has been submitted in the hope that it will stimulate discussion necessary for their correction. The author suggests that manufacturers of plasticizers could contribute by providing, along with other information, a comparison of the plasticizer amounts needed for 100% elongation at load of about 100 kg./sq.cm. (In German.)

"Supported Oxide Catalysts in the Production of Polythene," E. G. Curphey, *Brit. Plastics*, 31, 2, 63 (Feb. 1958).

The characteristics and the polymerization mechanism of the supported oxide catalysts are described and compared with those of the Ziegler catalysts. The techniques of polymerization of ethylene by supported oxide catalysts also are discussed.

"Irradiated Polyethylene," J. Leeuwerik and J. Heijboer, *Plastica*, 10, 10, 686 (Oct. 1957).

The progress made in the irradiation of polyethylene in America and England is reviewed, with examples quoted to show how the properties of the plastic (especially heat resistance) are improved by irradiation. (In Dutch.)

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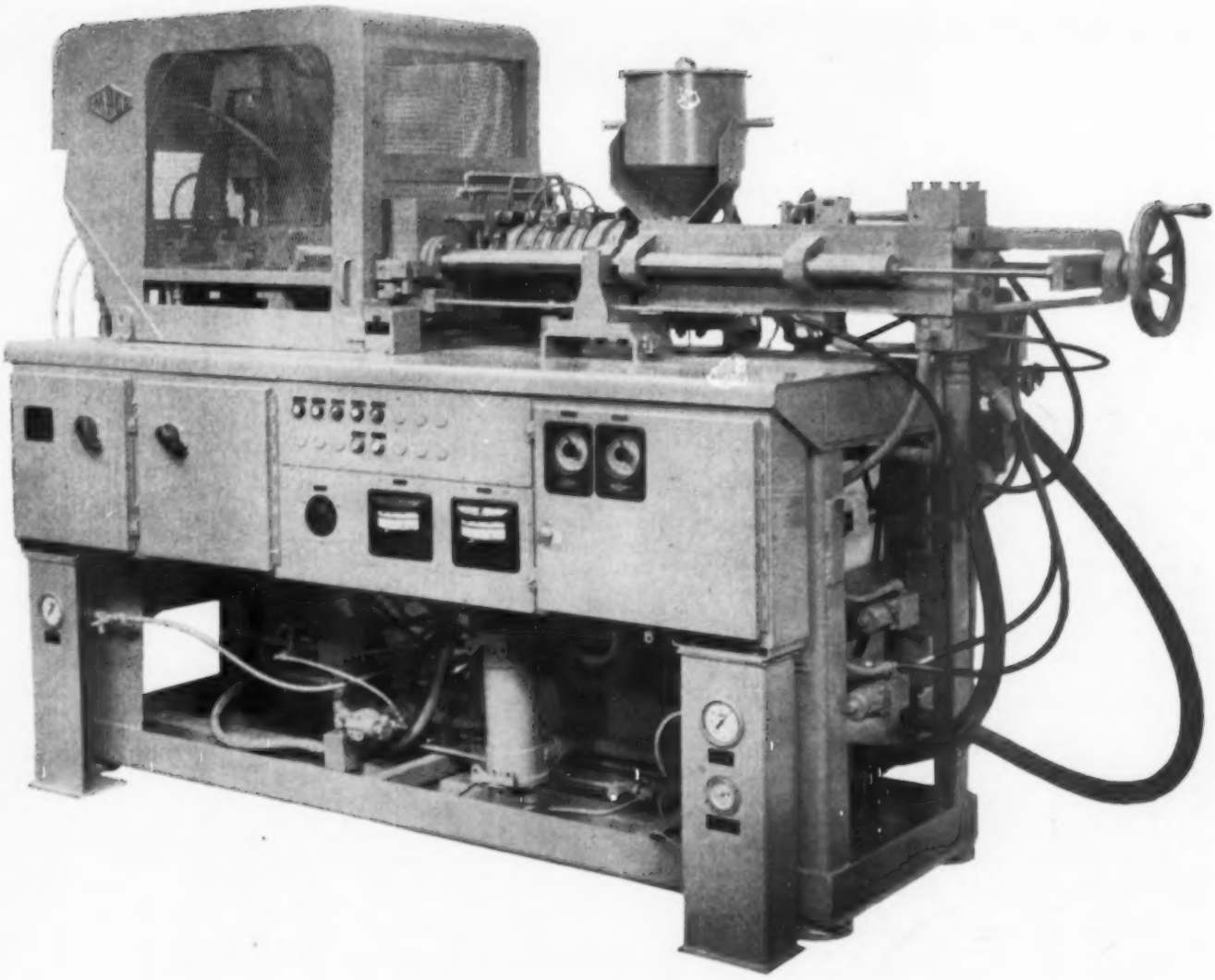

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"Creep and Stress-Rupture Behavior of Rigid PVC Pipe," J. H. Faupel, *Modern Plastics*, 35, 11, 120; 35, 12, 132 (July & Aug. 1958).

Creep and stress-rupture behavior of rigid PVC pipe are shown to be predicted from stress-relaxation data. Theoretical principles and some experimental results are given in Part 1, while Part 2 of the article presents further results and interpretation of the entire test pattern.

"The Resistance of poly-e-caprolactam to Micro-organisms," M. Bomar, *Plaste u. Kautschuk*, 4, 8, 287 (Aug. 1957).

Results of tests carried out in Czechoslovakia showed that micro-organisms do not attack poly-e-caprolactam if it is not contaminated with substances that serve as nutrients. When so contaminated, however, it is easily attacked. It appeared that high concentrations of the monomer tend to kill the micro-organisms, while low concentrations not only do not prevent their growth but, in some cases, may even promote it. (In German.)

Equipment

"Intensive Mixing," W. R. Bolen and R. E. Colwell, *SPE J.*, 14, 8, 24 (Aug. 1958).

The theory and mixing index of basic intensive mixers is discussed, together with the equation for calculating shearing stresses.

"High Vacuum Evaporation Plant for Metallizing Plastics," W. D. Nassauer, *Kunststoffe*, 48, 4, 165 (April 1958).

After a general discussion of the requirements as to priming varnish and metallizable plastics, the adhesion of layers and protective finishes for the process of metallizing plastics in high-vacuum evaporation installations are described, together with the method and equipment, and the economics of the method examined. (In German.)

"Extrusion Machines by Boundary-Layer Breakdown," E. Gabrielli, *Poliplasti*, 5, 24, 46 (Nov.-Dec. 1957).

Screws are used in extrusion machines all over the world for extruding synthetic resins, but a study of the performance of screws reveals their limitations. The author's efforts to find a new solution for extrusion problems resulted in the designing and building of a machine for extruding without screws, based on what he calls "boundary-layer breakdown." The theory is explained, and results obtained with machines constructed on the new principle are described. The machines are claimed to be very versatile, permitting the solution of a variety of manufacturing problems in calendering, as well as extrusion, for rubber and plastics. (In English).

"Electrical Equipment for Molding Machines," P. Gonde, *Matières Plastiques*, 4, 39, 57 (Sept. 1957).

The characteristics of electrical equipment for molding machines that are essential for satisfactory operation are explained by the examples of electronic timing devices and cycling relays, contactors and circuit breakers, etc. (In French.)

"High-Capacity Installation for Impregnating Paper with Synthetic Resin," W. Gutenberger, *Kunststoffe*, 48, 4, 159 (April 1958).

The German installation for impregnating paper with synthetic resin, described by the author, is claimed to combine large drying capacity with economy of space, so that output frequently is several times that of other dryers having the same dimensions. Papers with poor tear strengths in both wet and dry conditions also can be treated, and a vertical model can be provided for sheet that requires particularly careful treatment. (In German.)

"The Colombo Extruder," S. Beyer, *Kunststoffe*, 48, 4, 157 (April 1958).

The extruder with twin screws rotating in the same direction, developed by Roberto Colombo, Turin, Italy, offers special advantages in the processing of PVC suspensions, high-density polyethylene, and polypropylene. These advantages are examined, and construction details of the newest models of the machine are described. (In German.)

Processing

"Screw Extrusion of Granular Fluon p.t.f.e. Powder," E. M. Elliott, *Plastics, (London)*, 23, 244, 8 (Jan. 1958).

A method is described for the screw extrusion of granular Fluon powder in which the barrel of the machine is water-cooled and the powder is fed in a cold state to a heated die where it is compressed and sintered. The application of this method to the extrusion of tube and wire covering is discussed.

"Screen-Printing on Plastics," E. Mertes, *Kunststoffe*, 48, 2, 56 (Feb. 1958).

Screen-printing is particularly suited to decorating plastics, and several materials including PVC can be printed only by this process. The proper selection of printing inks, screen printing on polyethylene, foamed plastics, deep-drawn parts, as well as on round or conical packages; and multi-color work are all discussed. (In German.)

"Plastics Dies for Prototypes and Production," W. J. Esdale, *Plastics World*, 16, 7, 6 (July 1958).

The use of plastics for production dies and prototype dies by Allied Products Corp. is described.

"Off-set Printing on Plastic Products," H. Grauel, *Kunststoffe*, 48, 2, 93 (Feb. 1958). Off-set printing is possible on most plastics, and on rounded as well as flat surfaces. Its usefulness is limited by the oxidative drying of the special printing ink it requires and the relatively low output (for mass production) of the machines. The process and machinery for flat and uneven surfaces; for one-color and multi-color work; and for manual, semi-automatic, and fully automatic operation are described. Printing inks, quality of printing and adhesion to the plastic surface, protective lacquer coats, and artificial drying also are treated. (In German.)

"Injection Molding or Vacuum Forming?" J. Combette, *Ind. Plastiques Mod.*, 10, 2, 1 (Feb. 1958).

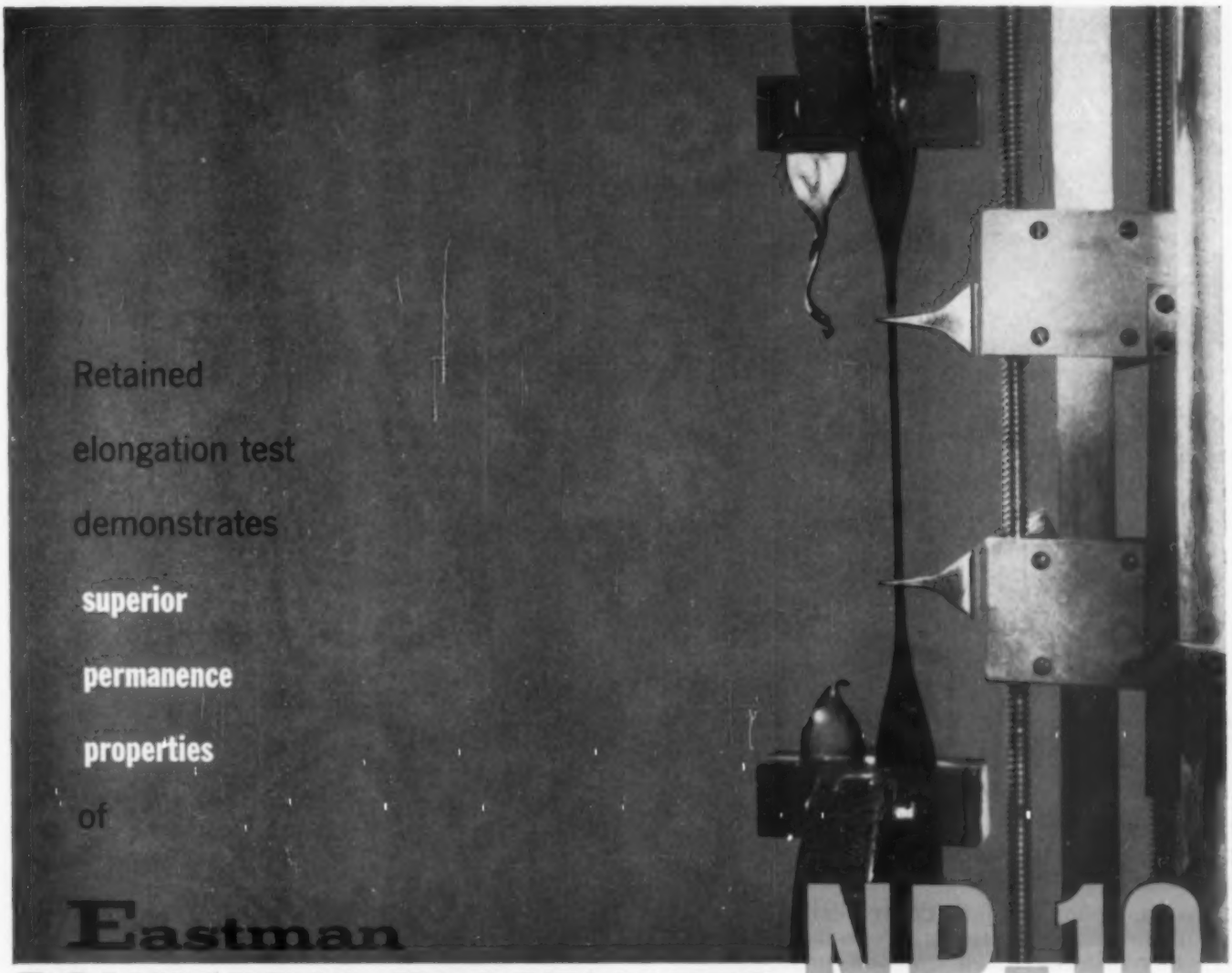
To help planners and engineers to choose between injection molding and vacuum forming in the production of a particular item, the author discusses the factors involved under size, thickness, and shape of the part to be made; the available materials for either process; the finish of products; machinery and molds; duration of the cycles; and the economics of production. (In French.)

"Reinforced Molding with Acrylic Sirup," J. A. Ross, Brian Mead, and J. T. Rundquist, *Modern Plastics*, 35, 12, 109 (Aug. 1958).

A description of how a new acrylic laminating resin is used to make such glass-reinforced products as corrugated, decorative, and flat sheets and complex shapes. The effects of process variables on quality are discussed.

"Spark Machining," M. Clerc. *Plastiques Inf.*, p.5 (Oct. 16, 1957).

Description of the Seleromat, a new



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"Boat Mold for Mass Production," F. M. Coleman, *Modern Plastics*, 35, 12, 121 (Aug. 1958).

Glass-reinforced epoxy shells designed in two pieces are shown to simplify production of 41-foot boats.

"The Production of P.T.F.E. Sheet and Solid Shapes," E. James, *Brit. Plastics*, 31, 1, 28 (Jan. 1958).

The equipment needed to produce P.T.F.E. sheet and solid shapes is described and the operations involved are discussed step-by-step, with many hints for best results. The need for cleanliness in equipment, personnel and atmosphere particularly is stressed.

"Production of Paste-forming Types of PVC by Spray Drying," D. Rysavy, *Kunststoffe*, 48, 3, 108 (March 1958).

At the Research Institute for Macromolecular Chemistry, Brunn, Czechoslovakai, the optimum conditions for producing paste-forming PVC in spray-drying installations (Nubilosa System), were examined. It was found that temperature in the drying tunnel is an essential factor in the production of PVC particles that, at room temperature, will form stable dispersions in plasticizer with good flow properties. The nature of the surface of the particles is determined by the drying method, and is more important than their size. A moisture content in polymers of less than 1%, by weight, does not affect flow properties of pastes made from them. (In German.)

"High-frequency Welding of Rigid PVC," G. Hartung, *Plaste u. Kautschuk*, 4, 8, 289 (Aug. 1957).

Detailed investigations have shown that it is possible to weld rigid PVC with the usual frequencies. However, optimum welding time is very important. The tendency for jagged weld seams could be reduced by changing the shape of the electrode, and welding could be facilitated by introducing soft PVC foil between the overlapping edges. The process is described, as applied to the welding of battery cases. (In German.)

"Fabricating Methods for Rigid PVC and other Thermoplastics," H. Jungnickel *Kunststoff-Rundschau*, 4, 9, 389 (Sept. 1957).

The author demonstrates the fabricating mistakes that must be avoided when plastics replace metals, using examples of the methods of connecting plastic pipe for various purposes and the forming of tanks and containers. (In German.)

"Gating Problems in the Processing of Plexigum," E. Friederich, *Plastverarbeiter*, 8, 9, 321 (Sept. 1957).

Problems connected with the injection molding of Plexigum are discussed, and various alternative types of gating are considered. (In German.)

"Decorative Surface Treatment of Plastics Sheet," *Kunststoffe*, 48, 3, 106 (March 1958).

The different methods for color-printing and embossing of plastic sheet are critically reviewed with the aim of showing how cooperation between technologists, designers, producers, and consumers, in the interests of economy, as well as esthetics, can lead to profitable production, new techniques, and new applications. (In German.)

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Applications

"Construction of the United States Pavilion, Brussels World's Fair," A. G. H. Dietz. *Plastics Industry*, 16, 8, 24 (Aug. 1958).

A brief description of the Pavilion that included approximately 140,000 square feet of reinforced plastics and some 40,000 square feet of vinyl chloride.

"Plastics Pipe for Conveying Drinking Water," J. H. F. Kalkman, *Plastics*, 10, 11, 802 (Nov. 1957).

It was not until 1948 that Dutch manufacturers began to show interest in PVC and polyethylene piping for conveying drinking water. The difficulties that had to be overcome and the progress that has been made since then in the Netherlands are described. (In Dutch.)

"Laying Plastics Pipelines," A. Minikus, *Kunststoffe*, 48, 4, 185 (April 1958).

A consideration of the advantages and disadvantages of rigid PVC and high-pressure polyethylene for pipe and fittings introduces a report on proven methods of laying and fixing the pipe, as well as on the right kind of pipe connections and the cementing of the fittings. The G. Fischer A. G. method of connecting pipe especially is dealt with. (In German.)

"Recent Developments in the Use of Rigid Low Density Materials in Plastics Structures," D. S. Mahon, *Trans. Plastics Inst.*, 26, 63, 69 (Jan. 1958).

The properties of available low-density, closed-cell types of materials, including thermoplastic, thermoset, and syntactic materials, are considered. Applications are described, in particular, low-density cores in the production of radomes, and syntactic materials in boat construction.

"Plasticized PVC Profiles on Steel Supports as Elements in Construction of Windows, Doors and Partitions," R. Frenz, *Kunststoffe*, 48, 4, 161 (April 1958).

The use in the construction of windows, doors and partitions is discussed of co-ordinated, mass-produced profiles of square steel tubing over which plasticized PVC is extruded. The production method and several applications are described, as well as results of severe aging, thermal, and sound absorption tests, and tests on mechanical properties, and resistance to water and chemicals. (In German.)

"Plastics in the Construction of Electro-Technical and Precision Parts," K. Rabe, *Kunststoffe*, 48, 3, 137 (March 1958).

High-grade apparatus and components can be made economically from plastics if the designer of the articles has due regard for the requirements of mold construction and, when necessary, first consults with the mold designer, as is made clear by a number of examples. The role of the properties and cost of a plastic material, and the right and wrong way to combine metal parts with plastics also are discussed. (In German.)

"Creating a 'Plastic Alloy' for the Footwear Industry," M. Mathé, *Ind. Plastiques Mod.*, 10, 4, 2 (April 1958).

In this rather informal paper, an exposition of the importance of PVC, its manufacture and requirements in service, is followed by a discussion of the tests which led to the development of the range of Garbels. Though they are vinyl products, the Garbels are designated "Plastic Alloys", rather than vinyl compounds, because of their special qualities developed to permit their use in the production of plastics footwear on extrusion-injection machines. The materials are translucent, available in all colors and are claimed to be resistant to temperature and abrasion. Precautions to be taken and dangers to be avoided in processing them are indicated. (In French.)

"Fibrous and Non-Fibrous Insulation for Use in High-Voltage Power Equipment," W. J. Renwick and R. H. Blewitt, *Trans. Plastics Inst.*, 26, 63, 23 (Jan. 1958).

The requirements of insulation systems for high-voltage equipment employing the newer materials are discussed and various testing techniques and equipment described, including the electrolytic tank techniques as aids in testing electric strength, and tests on surface tracking and resistance to corona and moisture. The importance is stressed of two testing devices: the A. C. discharge detector for measuring corona inception and corona extinction voltages; and a dispersion meter for non-destructive determination of moisture content.

"Synthetic Top Pieces for Shoes," J. D. Harris, *Rubber & Plastics Age*, 39, 2, 141 (Feb. 1958).

Details of formulations and test results are given for two compounds of acrylonitrile rubber and phenolic resin with silica filler, used in making small top pieces on high-heeled shoes.

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"Acrylic Molds for Casting Small Parts from Epoxy Resin," W. Stumpf, *Kunststoffe* 48, 4, 156 (April 1958).

Molds are described for embedding electrical parts for the radio industry, including patented molds for round condensers with axial wire connection and flat condensers for connection on one side. There also are mentioned a split mold for embedding condensers with radial connection, and a mold for casting housing. (In German.)

"Plastic Coverings on Metals," G. Besson, *Ind. Plastiques Mod.*, 10, 5, 8 (May 1958).

Plastic surface treatment of metals includes the application of organic paints, varnishes and enamels, as well as relatively thick coverings and linings. The chemical and physical properties of the materials chiefly used for these purposes are presented and their various applications to provide corrosion resistance, electrical insulation, abrasion resistance, and for decorative and other purposes are described in relation to their particular characteristics. (In French.)

"Coatings and Packaging for the Tropics," J. Margner, *Plaste u. Kautschuk*, 4, 7, 277; 4, 8, 323; and 4, 9, 360 (July, Aug. & Sept. 1957).

The climatic conditions in tropical countries are explained and, on the basis of tests carried out in Shanghai, and Berlin, recommendations are made on the types of protective coatings suitable for use on iron and steel parts, light metal or wood parts and for electrical wires and insulations. Special finishes as protection against termites and fungi also are dealt with, and a practical method for testing the resistance of a finish to fungi is mentioned. The importance of adequate packing for shipments to the tropics is stressed, and mention is made of cocoon packing for protection of machinery and parts by temporary, peelable PVC coats. (In German.)

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"SPE Journal"
65 Prospect St., Stamford, Conn.

"Transactions of the Plastics Institute"
6 Mandeville Place, London W. 1.
England

"Plastics in Agriculture: Experiments in Frame-forcing," F. Buclon, *Ind. Plastiques Mod.*, 10, 5, 26 (May 1958).

The author gives a detailed account of an experiment carried out on a relatively small plot in growing green beans under frames employing flexible foils of polyethylene and PVC. The problems relating to aging, permeability to gas, resistance to cold, size of foils, and type of frame are dealt with. An appeal is made to manufacturers to produce materials to meet the special requirements of agriculture, especially for France, where their use is likely to undergo considerable expansion. (In France.)

"Laminated Plastic Gears," G. J. Muller, *Materials Design Eng.*, 48, 3, 106 (Sept. 1958).

A review of the four types of reinforced plastic gears (types CE, L, LE and MC) that provide silent operation for high horsepower service.

"Protecting Wood from Decay with Reinforced Plastics," B. M. Zuckerman and Richard Mark, *SPE J.*, 14, 9, 40 (Sept. 1958).

A review of investigations by public and private organizations showing how a complete covering of reinforced plastics prevents decay in kiln-dried wood.

"Reinforcing Epoxy with Metal Fiber," A. P. Mazzucchelli, *SPE J.*, 14, 9, 31 (Sept. 1958).

The first of a two-part article dealing with new compositions for tools and dies that hold out great potential to the reinforced-plastics industry.

Patent Digest

Materials

Polyvinyl Chloride Resin Compositions Containing Organotin Mixed Salts of a Fatty Acid and Maleic Acid. No. 2,826,561. Carl R. Gloskey, Avenel, N. J. (to Metal & Thermit Corp., New York, N. Y.).

A stable polyvinyl chloride resin composition containing an organotin mixed salt of a fatty acid and maleic acid, wherein tin atoms are bonded directly to the acid radicals of both acids through their carboxy oxygens. The organotin portions of the salt are radicals selected from the group consisting of alkyltin, aryltin, and aralkyltin radicals; and the molar ratio of fatty acid radical to maleic acid radical in the composition is in the range of 2:1 to 3:1.

Stable Catalyzed Amine-Modified Urea-Formaldehyde Resin Compositions Containing Monohydric Alcohol and Excess Formaldehyde, and Methods of Producing Such Compositions. No. 2,827,441. Edward J. Romatowski, Maumee, O. (to Allied Chemical Corp., New York, N. Y.).

The resin is a stable aqueous solution containing from 35-75% total resin content, and having a pH value below 4.5. It consists of an aqueous solution of urea-formaldehyde resin which has been reacted in the presence of a water-soluble amine, an aliphatic, monohydric alcohol, excess formaldehyde, and an acidic catalyst.

Perchloric Acid Solution of Acrylonitrile Polymer and Method of Making Same. No. 2,826,558. Hans Binder, Rottweil, Neckar, Germany. (to Rottweiler Kunstseidefabrik A. G., Rottweil, Neckar, Germany.).

A solution suitable for producing shaped articles consisting of a copolymer containing at least 85% by weight of monomeric acrylonitrile; and an aqueous perchloric acid having a concentration of about 50% of $HClO_4$.

Heat-Hardenable Aminoplast Resin Molding Compositions, Their Manufacture and Molded Articles Therefrom. No. 2,830,035. Alfred Renner and Gustav Widmer, Basel, Switzerland. (to Ciba Ltd., Basel, Switzerland.).

The resin is selected from the group consisting of urea-formaldehyde condensation products, thiourea-formaldehyde condensation products, and condensation products of formaldehyde with aminotriazines containing at least two $-NH_2$ groups bound directly to the triazine ring. As catalyst, a diester is included consisting of a benzene monosulfonic acid containing one to two methyl groups as substituents in the benzene nucleus with a polyhydric aliphatic diprimary alcohol containing 2-10 carbon atoms.

Stabilization of Ethylene Polymers by Contact With Group VI Metal Compounds. No. 2,830,034. John T. Rundquist, Wilmington, Del. (to E. I. du Pont de Nemours and Co., Wilmington, Del.)

Ethylene polymers containing at least 15 x 10^4 milliequivalents of hydroperoxides per gram are contacted with a molybdenum sulfide catalyst at temperature between 80-350° C.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.

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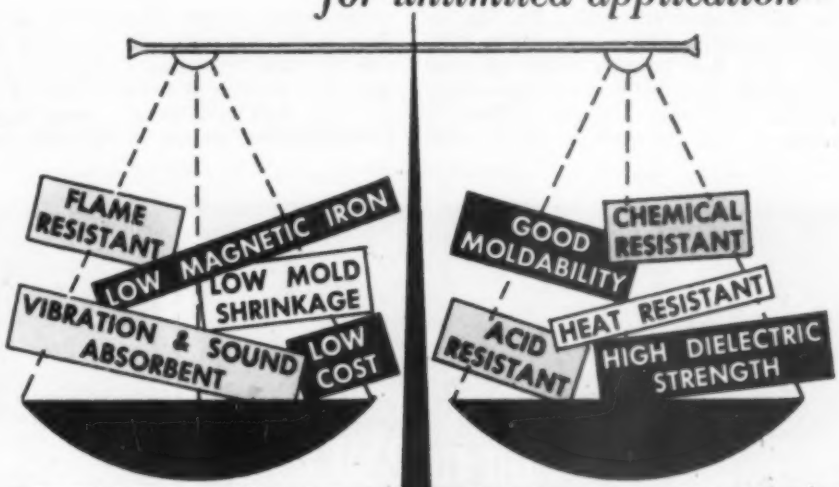

. . . An outline of its unusual properties Powhatan Mining Co. is the exclusive producer of Powminco asbestos fiber, used as a filler and an absorbent and extender in phenolic and polyester resins. It is the only completely fiberized acid resistant asbestos fiber in the United States.

Powminco Asbestos is practically inert. It is not affected by as much as four hours boiling in concentrated hydrochloric acid. This gives it a distinct advantage over ordinary chrysolite fiber when used in molding compounds that require an acid catalyst (phenolics, for example), and in casting resins.

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Cured Resinous Compositions of Phenol, Melamine, and Formaldehyde and Process of Preparing Same. No. 2,826,559. Ivor H. Updegraff, Stamford, and Nicholas R. Segro, Fairfield, Conn. (to American Cyanamid Co., New York, N. Y.).

A potentially-thermosetting resinous composition is prepared by mixing a thermoplastic resinous composition with a reactive, cross-linking, hardening agent. This compound is used to impregnate a filler which is dried and comminuted. The thermoplastic component is prepared by adding phenol to a melamine-formaldehyde solution and reacting the composition at reflux temperature until it hydrophobes. The excess water is removed and a water-soluble alcohol is added to produce a resinous syrup.

Equipment

Injection Molding Press Having Valved Gate. No. 2,828,507. William Strauss, Philadelphia, Pa. (to F. J. Stokes Corp., Philadelphia, Pa.).

In the channel connecting the injector and die cavity, a pin is arranged to slide between a first position which permits resin to flow; a second position wherein the pin seals the channel while its tip forms a portion of the die surface; and a third position in which the pin seals the channel while its tip projects into the die cavity.

Machine for Draw or Drape Plastic Molding. No. 2,832,094. Fred A. Groth, Chicago, Ill.

This apparatus consists of an open ended heating oven, mounted for reciprocal movement on a horizontally disposed table. The heating elements are rod-supported between the sidewalls, and a plastic sheet holding frame is located at each end of the table. A male mold is positioned beneath the frame to receive the heated sheet. The frame is lowered by means of a pivoted rocker arm that communicates, through suitable linkage, with vertical rods connected to each of the frames.

Extrusion Apparatus. No. 2,829,399. Vincent Peter Caracciolo and Robert Nord Peterson, Wilmington, Del. (to E. I. du Pont de Nemours and Co., Wilmington, Del.).

This screw extruder comprises four sections in the following order: a feed section the helix of whose grooves has an opposite direction of twist to that of the screw, as well as a greater pitch length; a compounding section whose inside surface is smooth and whose annular cross sectional area between the barrel and the root of the screw is less than one-half of the corresponding cross sectional area of the feed section; a vacuum extraction section; and an extrusion section.

Forming Test Apparatus for Thermosetting Plastic. No. 2,831,344. Paul H. Kaar, Wilmette, and Edmund Frank, Chicago, Ill. (to U.S.A. as represented by the Secretary of the Air Force.)

This machine performs bending tests on plastic materials and comprises a base-mounted work-supporting element whose arcuate surface for supporting the test specimen has a decreasing radius of curvature; clamps for holding the work in contact with the arcuate surface; a roller element for applying forming pressure to the specimen; a roller element which can be moved toward the specimen at a constant predetermined pressure; and means for rotating on the elements relative to the other so that the plastic specimen can be bent with a continuously decreasing bend radius until fracture occurs.

Processing

Process of Manufacturing Composite Pipe. No. 2,824,033. Chase Donaldson, Mt.

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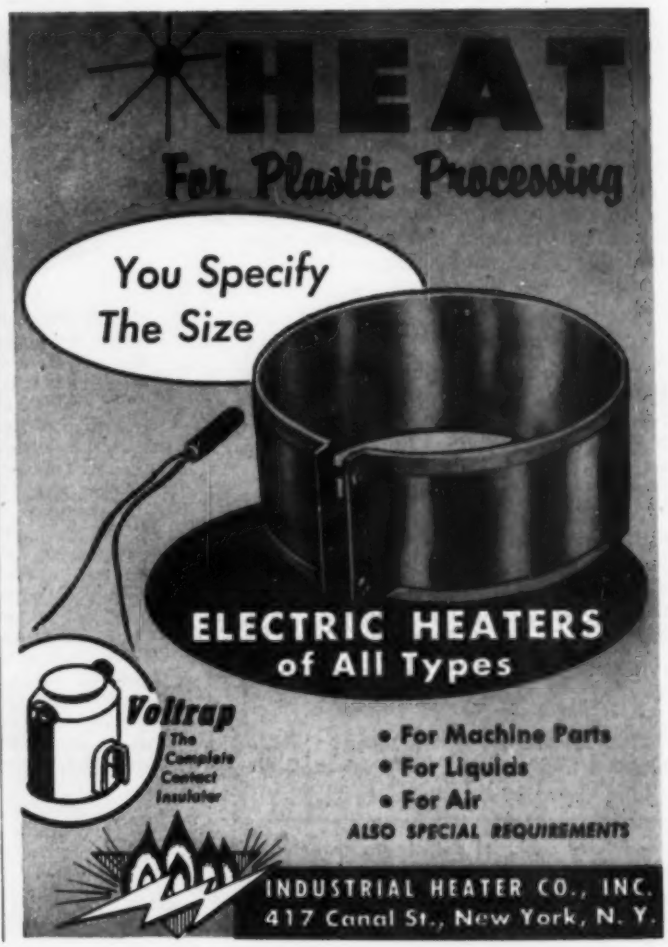

Vernon, N. Y.

Two spirally-wound tubes of different diameter are formed from a plurality of continuous fibrous tapes impregnated with a heat curable resin. The smaller tube carries a superposed layer of resin-impregnated filler media to which a layer of heat curable adhesive has been applied. It is inserted in the larger tube, and the assembly is heated to unite the several elements and to cure the resin matrix in situ.

Method of Impregnating a Fabric With Polyethylene. No. 2,824,034. Charles R. Worby, Eau Claire, Wis. (to United States Rubber Co., New York, N. Y.).

Polyethylene film is softened and heated on a calender roll after which it is fed through the nip of an adjacent roll together with the fabric web to be impregnated. Friction is produced by rotating one roll faster than the advancing web, with the result that the film is impregnated into the fabric.

Plastic Grommets and a Method for Forming Them. No. 2,821,764. James F. Leahy, Beverly, and Charles B. Noonan, Newburyport, Mass. (to United Shoe Machinery Corp., Flemington, N. J.).

The grommet is formed on both sides of two or more layers of plastic material. It consists of two annular sections connected by an integrally-formed barrel surrounded by similarly formed legs. The barrel and legs pass through holes in the sheet material, alternate layers of which are deflected toward the opposing annular sections.

Extrusion Process. No. 2,824,781. Arthur F. Dellheim and Lee F. Samler, Baltimore, Md. (to National Plastics Products Co., Odenton, Md.).

After extrusion, polystyrene filaments are guided into a liquid bath at 240-260° F. They are cooled to a temperature below the softening range of the polystyrene while moving in an uninterrupted straight-line flow.

Applications

Inflatable Brassiere. No. 2,826,202. Sydney Star, Laurelton, N.Y.

The body portion and a pair of bust-receiving cups are fabricated of an air-impervious, heat-sealable thermoplastic material. First and second cup forming members are positioned one within the other and are joined at their peripheral portions by a heat sealed band to form an air-retaining space. The cups are provided with a valved inlet which permits the introduction of an inflating medium and prevents its loss.

Plastic Coated Articles. No. 2,830,721. Jules Pinsky, West Hartford, Albert E. Adakonis, East Hartford, and Alvin R. Nielsen, Hartford, Conn. (to Plax Corp., Bloomfield, Conn.).

A polyethylene bottle having increased resistance to permeation by organic fluids whose surface has been treated to promote adhesion of polar compounds having a strongly adherent coating of cured epoxy resin.

Plastic Feather and Method for Making Same. No. 2,830,818. Robert S. Otto, Evanston, Ill.

A laminated plastic arrow-feather is made of vinyl base sheets and polyethylene sheets. It is characterized by a plurality of spines which slope rearwardly to intersect the long axis of the feather at an acute angle. A fletching base is integral with the feather body and is offset with a flat under-portion of the vinyl base sheet which serves as a surface for attachment to the arrow.

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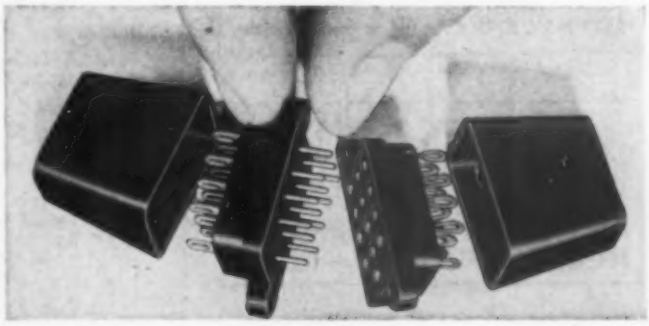

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Current Market Prices

Price Changes and Additions

Plasticizers			
Kay-Fries diethyl phthalate	lb.	$0.275 /	$0.36
dimethyl phthalate	lb.	.28 /	.365
Monsanto dibutyl phthalate	lb.	.30 /	.335
diethyl phthalate	lb.	.29 /	.325
dimethyl phthalate	lb.	.295 /	.33
diphenyl phthalate	lb.	.53 /	.55
DIDP	lb.	.29 /	.325
DOA, DIDA	lb.	.40 /	.435
DOP, DIOP	lb.	.28 /	.315
DNODA	lb.	.40 /	.435
HB-20	lb.	.15 /	.17
HB-40	lb.	.19 /	.22
Tricresyl phosphate	lb.	.325 /	.36
Triphenyl phosphate	lb.	.415 /	.435
Resins & Molding Compounds			
Epoxy			
Epon 562	lb.	1.09 /	1.12
815, 820	lb.	.65 /	.71
828	lb.	.62 /	.685
834	lb.	.75 /	.785
834-X-90	lb.	.685 /	.715
864	lb.	.885 /	.92
864-C-75	lb.	.6525/	.6625
1001	lb.	.575 /	.5825
1001-A-80	lb.	.515 /	.525
1001-BT-70	lb.	.4375/	.4675
1001-CX-75	lb.	.465 /	.495
1001-T-75	lb.	.47 /	.48
1002, 1007	lb.	.555 /	.5625
1004	lb.	.50 /	.535
1007-CT-55	lb.	.395 /	.405
1009	lb.	.63 /	.6375
Vinyls			
Exon 402-A, 500, 666, 905, 911, 914, 921, 924, 931 965	lb.	.25 /	.43
425, 450	lb.	.32 /	.50
461	lb.	9.75	
468	lb.	.30 /	.48
470	lb.	.48 /	.66
471	lb.	.45 /	.63
487	lb.	.275 /	.455
650, 654	lb.	.28 /	.46

CALENDAR of COMING EVENTS

Oct. 20-22
13th Tappi Plastics-Paper Conference. Sheraton-Kimball Hotel, Springfield, Mass.

Oct. 21
SPE Upper Midwest Section. RETEC—Epoxies. Curtis Hotel, Minneapolis, Minn.

Oct. 23
SPE N.W. Penna. Section. Penn Laurel Motel, Warren, Pa.

Oct. 24
SPE Golden Gate Section. RETEC—Plastics in Electronics. Stanford Research Institute, Menlo Park, Calif.

Oct. 30-31
ASTM Committee D-20. International Symposium on Plastics. Benjamin Franklin Hotel, Philadelphia, Pa.

Nov. 3-7
American Standards Association. ISO Technical Committee 61-Plastics. Washington, D. C.

Nov. 5-6
Annual Fall Meeting, Society of Vacuum Coaters, Hotel Statler, Detroit, Mich.

Nov. 6
SPE Philadelphia Section, RETEC Advances in Injection Molding. Sheraton Hotel, Philadelphia, Pa.

Nov. 13
SPE Southern California Section. RETEC—Plastics in Building and Construction. Ambassador Hotel, Los Angeles, Calif.

Nov. 14-23
Second Plastics Technical Fair and Exhibit, Madrid, Spain.

Nov. 17-21
Eighth National Plastics Exposition. Int'l Amphitheatre; SPI Conference, Hotel Morrison, Chicago, Ill.

Dec. 2-4
U.S. Army Signal Research and Development Lab. Seventh Annual Wire and Cable Symposium. Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 3-4
Builders Research Institute, Paints and Coatings. Washington, D. C.

Domestic Production and Sales of Plastics and Resin Material, May and June, 1958

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of May and June, 1958. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Production and sales volumes of cellulosics, urea and melamine resins, styrenes, as well as polyesters, seem to have leveled off and, with the exception of the latter, are slightly below the figures for this period last year. Polyesters are 10% higher than in 1957, while polyethylenes have increased 15–20%. Vinyls are gaining but still lower than 1957.

	May, 1958		June, 1958	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,343,758	1,380,807	1,788,115	1,743,712
Sheets, 0.003 gage and over	1,535,695	1,431,515	1,403,411	1,554,330
All other sheets, rods, and tubes (including other cellulose plastics)	757,262	628,002	851,287	676,438
Molding and extrusion materials (including other cellulose plastics)	6,874,022	6,833,187	6,175,538	5,841,068
Nitrocellulose sheets, rods, and tubes	246,485	270,764	231,043	244,882
TOTAL	10,757,222	10,544,275	10,951,583	10,060,430
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	11,725,440	11,449,180	11,758,703	11,220,637
Bonding and adhesive resins for—				
Laminating (except plywood)	4,158,632	2,774,670	4,869,009	3,094,686
Coated and bonded abrasives	817,809	812,974	850,430	822,045
Friction materials (brake linings, clutch facings, and similar materials)[2]	846,595	636,070	1,092,463	1,009,796
Thermal insulation (fiber glass, rock wool)	3,960,043	4,328,702	3,424,051	3,584,929
Plywood	4,060,612	3,318,577	4,025,079	3,370,646
All other bonding and adhesive uses	2,434,396	2,454,965	2,786,383	2,833,173
Protective-coating resins unmodified and modified except by rosin	2,084,589	1,990,584	2,119,680	2,296,383
Resins for all other uses	2,245,751	1,829,273	2,369,574	2,006,797
TOTAL	32,333,867	29,594,995	33,295,372	30,239,092
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,558,518	2,344,326	2,396,096	2,269,896
Paper-treating and paper-coating resins	1,811,767	1,668,312	2,002,931	1,977,953
Bonding and adhesive resins for—				
Laminating	2,769,930	1,754,561	2,426,941	2,102,343
Plywood	7,203,613	7,885,810	7,429,787	6,907,995
All other bonding and adhesive uses	976,991	825,098	784,206	925,737
Protective-coating resins, straight and modified	2,225,374	1,834,467	2,452,787	2,027,747
Resins for all other uses, including molding	7,894,319	6,805,120	6,008,602	6,109,534
TOTAL	25,440,512	23,117,694	23,501,350	22,321,205
Styrene Resins:				
Molding materials[1]	36,372,131	42,555,808	35,393,707	33,322,369
Protective-coating resins, straight and modified	7,297,670	7,497,043	7,747,935	7,460,564
Resins for all other uses	12,142,486	9,705,729	12,118,817	8,503,164
TOTAL	55,812,287	59,758,580	55,260,459	49,286,097
Vinyl and Vinyl Chloride Resins:[3]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		5,534,058		5,986,162
Sheeting (resin content)		5,330,677		5,716,281
Molding and extrusion (resin content)		15,957,969		16,204,724
Textile and paper treating and coating (resin content)[3]		4,768,873		5,461,798
Flooring (resin content)		10,346,689		9,117,289
Protective coating (resin content)		2,517,929		2,518,194
All other uses (resin content)		5,518,631		4,019,724
All other vinyl resins for—				
Adhesives (resin content)		3,674,757		3,931,609
All other uses (resin content)		9,148,997		9,399,342
TOTAL	56,785,484	62,798,580	57,748,743	62,355,123
Coumarone-Indene and Petroleum Polymer Resins	18,881,231	19,208,997	17,671,795	17,142,917
Polyester Resins:				
For reinforced plastics	9,912,640	9,051,496	9,437,472	8,470,452
For all other uses	955,603	989,192	1,305,897	1,088,554
TOTAL	10,868,243	10,040,688	10,743,369	9,559,006
Polyethylene Resins:				
For film		23,669,760		23,489,478
For all other uses		37,914,307		40,057,999
TOTAL	70,963,345	61,584,067	68,067,887	63,547,477
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding Materials[1,4]	3,221,296	3,226,929	3,622,608	3,596,487
Protective-coating resins[5]	1,160,407	713,675	1,523,495	719,402
Resins for all other uses[6]	12,612,372	10,809,773	11,720,529	10,626,941
TOTAL	16,994,075	14,750,377	16,866,632	14,942,830
GRAND TOTALS	298,836,266	291,398,253	294,107,190	279,454,177

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesives uses."
SOURCE: United States Tariff Commission, Chemical Division.

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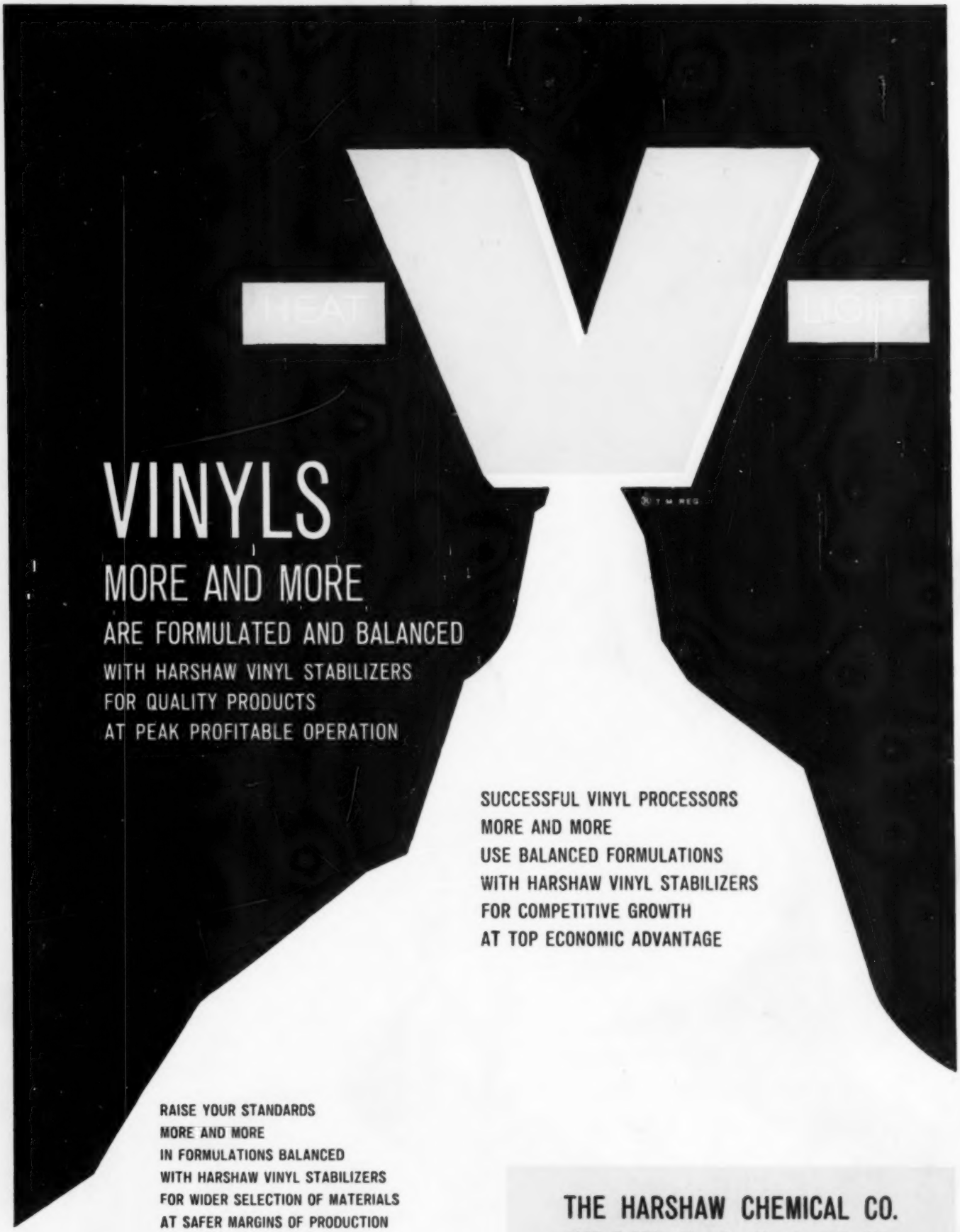

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